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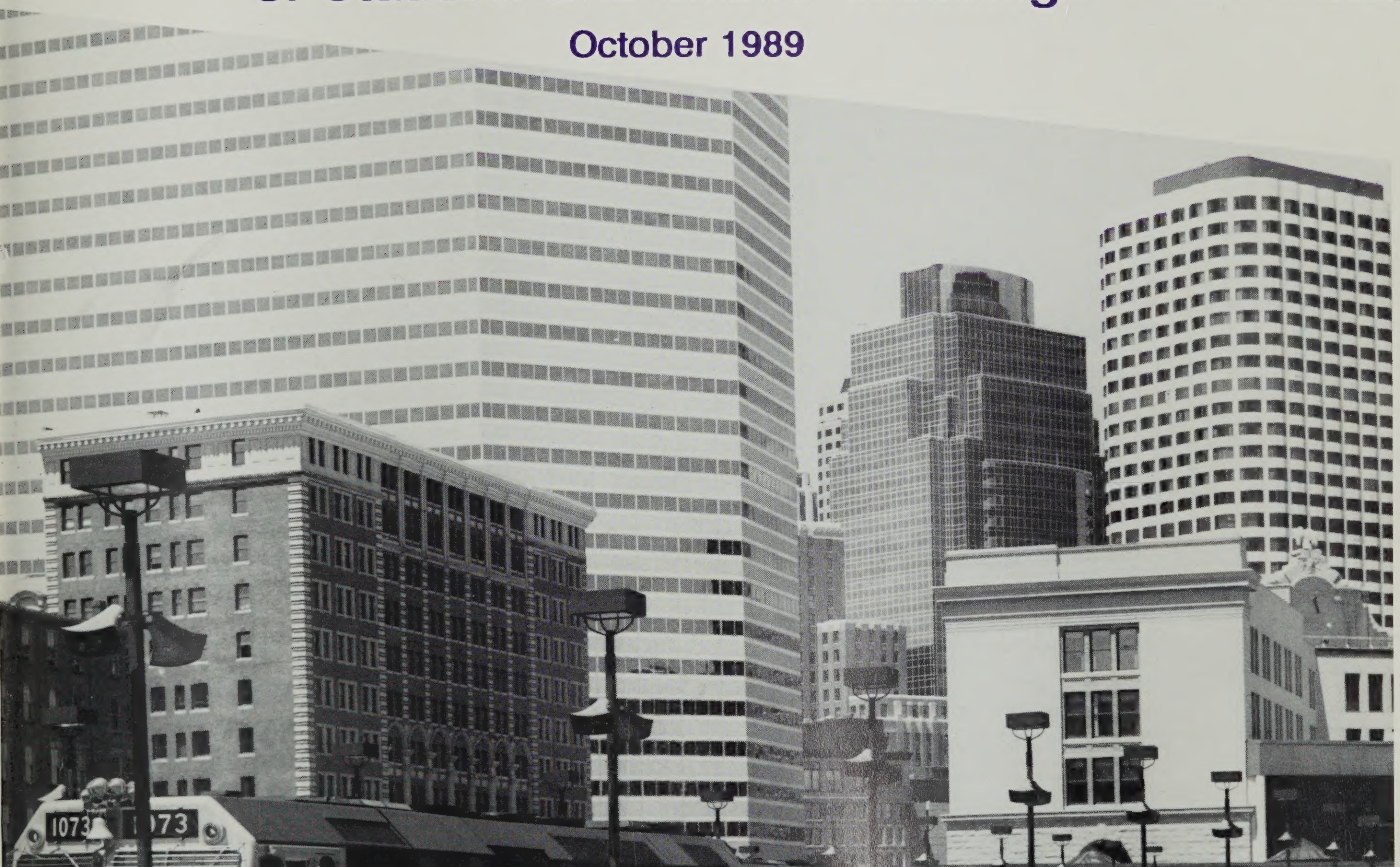

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OLD COLONY RAILROAD REHABILITATION PROJECT

METHODS AND RESULTS REPORT:
ANALYSIS OF TRAFFIC IMPACTS OF STATIONS AND GRADE CROSSINGS

October 1989
with
November 1989 Amendments

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Prepared by

Sverdrup Corporation
and
Cambridge Systematics, Inc.

In association with:

Bryant Association, Inc.
Thomas K. Dyer, Inc.
Carol R. Johnson and Associates, Inc.
Leers, Weinzapfel Associates, Architects, Inc.

OLD COLONY RAILROAD REHABILITATION PROJECT
METHODS AND RESULTS REPORT:
ANALYSES OF TRAFFIC IMPACTS OF STATIONS AND GRADE CROSSINGS

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OLD COLONY RAILROAD REHABILITATION PROJECT
METHODS AND RESULTS REPORT:
ANALYSES OF TRAFFIC IMPACTS OF STATIONS AND GRADE CROSSINGS

A. INTRODUCTION

This document contains detailed traffic information on the proposed reactivation of the Old Colony Railroad on one or more of the three branch lines, extending from South Station to Middleborough, Plymouth, and Greenbush in Scituate. Traffic impact analysis for the project has concentrated upon two primary sources of interaction between the railroad and the highway system: proposed railroad stations along the line, which are expected to generate vehicular traffic, and railroad/highway grade crossings, where train passbys will require temporary blockage of highway traffic with resulting delays.

The Report chapters are arranged by line segment, in the same format used for the Methods and Results Report: Social, Economic, Environmental Impact Assessment, November 1987. Most line segments include one proposed station location, and some segments also include grade crossings which require protective measures. Information in this report is necessarily dated, however, and although every effort has been made to keep the data current, changes do occur which are not reflected in this report.

B. METHODOLOGY

1. Existing Traffic

Peak Hour turning-movement traffic counts were conducted in the vicinity of each station as proposed. Initially, one or two counts were performed for each station location in order to provide a general characterization of the area of the proposed station, and to identify areas of potential traffic conflicts. Later, additional counts were conducted as station locations became more firmly established, to provide existing traffic bases for use in estimating future traffic levels.

A total of 72 AM and PM peak hour turning movement counts were conducted, primarily over the summer periods of 1986 and 1987. The raw count data is presented in the Appendix to this document. This volume of count information still represented fairly thin coverage over the entire project area, which covers 20 towns and as many as 25 different station locations. To supplement these counts, traffic studies for identified private development projects and/or publicly-sponsored transportation improvements were collected from study area towns. Available counts from those studies were converted to 1987 base year and used in conjunction with our own new counts.

All traffic counts were annualized using factors derived from MDPW permanent counting stations at 3 locations:

- Hingham Route 3 south of Derby St.

-	Brockton	Route 123 at Abington Town Line
-	Sharon	Route 27 at Stoughton Town Line

The location with the greatest traffic fluctuation is Route 3 in Hingham, where peak summer ADT volumes are around 18 percent higher than average annual volumes.

2. Base Traffic Growth

Year 2000 was selected as the Design Year for evaluation of railroad station impacts, including traffic impacts. In order to estimate likely growth of Base traffic to that year (i.e., background growth likely to occur in each area between the present day and Year 2000 regardless of railroad reactivation), two approaches were used.

First, the population growth factors which had been used to generate station demand estimates were also used to estimate future background growth rates. With a few exceptions (e.g., Middleborough in the area of I-495), most of the study area towns are essentially residential, and are expected to remain so. Consequently, population growth rates were the starting point for estimating traffic growth; but were adjusted to include other factors:

- the attractiveness of certain towns to through traffic generated by particular uses (e.g., Braintree near the Red Line Station).

- the degree of relative development saturation in some area compared with others, and the degree to which some towns appear to encourage or discourage new development.

In some towns, the population growth estimate to Year 2000 was essentially flat. For most locations, however, a minimum background growth rate of 1 per cent per year uncompounded, or 13 percent overall growth to Year 2000 was assumed where no population growth was projected by forecasts.

In addition, towns were canvassed for information regarding pending development projects in the vicinity of the station site. In some locations, information about the types of development and the level of traffic expected to be generated were used to revise the growth percentages based mainly on population forecasts. In other locations, development traffic was explicitly included in base traffic assumptions in addition to the annual growth factor. For example, the shopping center proposed for Pearl Street, Braintree, will generate traffic which was explicitly included in the base traffic forecasts against which station volumes were compared.

3. Accident Data

The study team contacted the Police Departments in each of the area towns, to obtain historical information on accident incidence at locations close to station sites wherever possible. This data was supplemented by additional accident data provided by the Old Colony Planning Council (OCPC) and the Southeastern Massachusetts Regional Planners and Economic Development District

(SRPEDD). In most of the Towns contacted, it was difficult to obtain information on anything but the absolute numbers of accidents which occurred, and the time of year of occurrence. This data is reported, but few conclusions can be drawn from such information within estimates of traffic volume exposure.

At some locations where the absolute numbers seemed high, an attempt was made to calculate an accident rate per million entering vehicles per year, and to compare the resulting rate with statewide averages for signalized and unsignalized intersections. The calculation of these rates rests on heroic assumptions about percent of ADT represented by peak-hour traffic, and degree of variation between weekday and weekend traffic volumes. They should therefore be viewed only as gross indicators, rather than absolute indices of safety performance.

4. Station Traffic

Station demand forecasts were produced by Cambridge Systematics, Inc., (CSI) for alternative scenarios involving operations of different line combinations:

- Middleborough Branch only
- Middleborough and Plymouth Branches
- Middleborough and Greenbush Branches
- Middleborough, Plymouth, and Greenbush Branches

All alternative combinations included full commuter rail operation from South Station to the terminus of each respective line--a Middleborough station at I-495, a Plymouth station at Hedge Road plus a major parking facility at Route 3 as the penultimate station on the Plymouth Branch, and a Greenbush station at Greenbush in Scituate.

For each station on each line, one of the four alternative combinations represented the "maximum" case in terms of boardings and potential parking vehicles. For Middleborough Branch stations, Alternative 3a ("Middleborough only") was the maximum demand scenario. For Plymouth and Greenbush Lines, the alternatives which include only those lines with Middleborough were the maxima. For each station, this maximum demand scenario was used to estimate traffic impacts; so that, in the event that the alternative ultimately selected is Alternative 3d (all 3 branches), all traffic forecasts presented here will be overestimates.

The AM and PM Peak Hours were selected as the basis for determining traffic impacts, because these are the hours when the roadway system is under greatest stress in most areas, and because these will be the hours of greatest commuter railroad/ station activity under the planned operating schedules. Because most of the Old Colony will operate as a single-track system, current plans call for half-hour headways on all three lines during peak morning and evening hours, staggered by a minimum of 5 minutes to allow convergence on the single track between Braintree and Boston. Thus, two northbound trains will operate on each line during the AM Peak Hour. In addition, one return train will operate during the AM Peak Hour, operating on a slow schedule because of the need to give way to peak-direction trains.

It is possible that some peak-period trains may be spaced more closely than 30 minutes, but no closer together than 5 minutes. This is particularly critical at Pearl Street in Braintree, which is the only place on the Old Colony Line where two branches converge at a single grade crossing.

During daytime off-peak hours, it is envisaged that roughly 2-hour headways would operate on activated lines.

Based on past MBTA counts, it is anticipated that 60 percent of daily station arrivals will occur during the peak hour. This assumption was used to convert patronage estimates by mode of access to anticipated arriving and departing vehicles in both Peak Hours. Both park-ride and drop-off patrons were converted to peak-hour arriving and/or departing vehicles, with drop-offs representing both an arrival and a departure in each peak hour. Parking vehicles are assumed to arrive during the AM Peak Hour and depart in the PM Peak Hour.

Counts at existing commuter rail stations showed that 60 percent of arriving station traffic occurs in the peak 15 minutes, but that this is divided into the 5-minute periods preceding each train arrival when there are multiple arrivals per hour. Consequently, hourly station arrival rates were applied for purposes of Level of Service analysis, conceding that actual arrivals are probably platooned into shorter, more intense periods. For purposes of queue length estimation, however, a "maximum arrival rate" concept was used for estimation of maximum likely queue lengths. This is described under "Grade Crossings" below.

The roadway network of concern was defined as the immediate vicinity of each station, out to the nearest intersection(s). In locations where significant impact appeared to be caused by station traffic at the nearest intersections, the study area was broadened to include a greater area (e.g., at Greenbush, and in the vicinity of the proposed Route 3 station in Kingston). In some cases where supplementary traffic counts could not be conducted, this necessitated the estimation of existing traffic volumes. This generally occurred only at minor intersections serving only local residential traffic. Such estimated volumes are presented on the report's traffic diagrams enclosed in parentheses.

Patronage forecasts provided by CSI included towns of origin for each station. Station-generated peak hour traffic was distributed on the traffic networks developed for each station using this origin information. Within the station town itself, direction of access was estimated based on station location relative to existing population and activity centers within the town.

In all cases, station-generated traffic was added directly to base traffic. No adjustment was made to account for the fact that some station traffic will represent trips currently being made by automobile in the vicinity of the station site. This is particularly likely at the stations which will serve primarily local traffic. It is less likely at stations which will draw from a wider regional market, such as Route 3 or Middleborough/Lakeville.

Feeder bus operations are not explicitly accounted for in these forecasts, only private passenger automobiles. At some stations however, bus access will be particularly important, notably those where parking is constrained (e.g., Holbrook- Randolph) and those located in denser, more urbanized areas (e.g., Brockton, Bridgewater) where a well-patronized local bus service already exists. At such stations, curb cuts and drop-off areas will be designed to permit easy bus access.

5. Level of Service Analysis

At each location, critical intersections were subject to analysis using the Level-of-Service (LOS) techniques outlined in the 1985 Highway Capacity Manual (Transportation Research Board Special Report 209, chapters 9 and 10). These techniques are used to evaluate operations at each intersection by comparing available capacity with demand volumes for each traffic movement to be served. Analysis runs were performed using the CINCH computer program, developed by Dan Beagan at the Central Transportation Planning Staff (CTPS) and distributed and supported by U.S. DOT. Level-of-Service sheets for all analyses are available for review; they are voluminous, however, and so are not included in this document.

Different procedures exist for signalized, vs. unsignalized, 3- and 4-way intersections. However, all intersection operations are characterized by a letter grade ranging from "A", representing essentially free-flow conditions with little or no delay and vehicle conflicts; to "E", under which some traffic movements experience long delays. Level of Service "F" is reserved for conditions where demand exceeds capacity, operations are unstable, and intersection breakdown or blockage occurs regularly.

For signalized intersections, the determination of Level of Service is based on the average delay to all movements, given demand volumes, intersection geometry and a particular signal timing configuration. For example, a calculated average stopped delay per vehicle of 15-25 seconds represents an LOS value of "C". A separate LOS value is calculated for each lane group permitted to move during the operation of a signal cycle. Two phases are more efficient than multi-phase operation, because each additional phase requires a loss-time period, or change interval, during which the permitted- move signal turns yellow, then all-red. A single LOS value characterizing the entire intersection is then derived by averaging the average stopped delay per vehicle for all vehicles entering the signalized intersection.

Table B-1 replicates the Table from the Highway Capacity Manual (HCM) which assigns LOS values based on different values of average delay to critical movements.

At unsignalized intersections, a priority of operations is presumed to exist, with through movements on the major street having the right of way over all minor-street operations. The critical movements at unsignalized intersections are the left turns into and out of the minor streets, and through movements which cross the major street. Each of these movements is assigned an LOS value, but no overall intersection LOS is calculated. Consequently, the results are presented in this report separately as left turns from major into minor street, right turns out of the minor street, and/or left turns out of the minor street, with only values of C or lower reported.

It should be noted that Level-of-Service analysis is a useful tool for estimating the ability of existing geometry to handle increased volumes. But the procedures are not sensitive to other complications caused by, for example, nearby grade crossings or intersecting streets which restrict queue lengths. In addition, the computer methods used to perform LOS analysis, particularly for signalized intersections, are not adapted to handle 5+ leg intersections, such as Howard/Montello in Brockton. For these intersections, a variation of the 1985 HCM procedure, called Critical Movement Analysis, was applied, and is reported separately.

6. Grade Crossings

It is anticipated that all public railroad-highway grade crossings will be equipped with full gate closure equipment, including bells and signals, which will be activated approximately 30 seconds before a train passby occurs. Because such controls will be provided, crossing sight-distance is not anticipated to be a problem requiring additional attention.

Consequently, analysis of grade crossings focused on estimation of the maximum queue lengths likely to develop in the vicinity of grade crossings, particularly near major roadway intersections. Two types of queues were considered: queues backing up from the track as a result of an impending train arrival and gate closure; and queues backing up from the stop line of a nearby intersection, with the potential to back across the track at a time when a train arrival is anticipated.

The former queues occur at all grade crossings, and are of interest primarily because: (a) traffic will be delayed on both sides of the crossing; and (b) queues may back up into an adjacent intersection, causing blockage and a potential safety risk.

The latter occur only at crossings located within range of busy intersections, usually signalized. It is required that traffic signals located within 200 feet of a grade crossing include a pre-emption sequence activated by the train when a train passby is imminent. The pre-emption sequence operates to clear traffic movements which cross the track by giving them an immediate green indication, with a red indication to all other movements. Such pre-emption would be included in all qualifying traffic signals, including new signals installed as part of this project.

At other busy locations located farther than 200 feet from a crossing, queuing analysis was undertaken to determine whether some form of signal pre-emption was nevertheless recommended. Finally, at several presently unsignalized intersections--notably at South Hanson and Plymouth/Summer Streets in Bridgewater--new signals with pre-emption are proposed primarily to clear left-turn queues which are likely to back up across the track.

Maximum likely queue lengths were derived as follows:

- A maximum train passby period, from gates-down to gates-up, was assumed to be 90 seconds. This assumption was based on field timing of existing grade crossing operations at Holbrook-Randolph, Route 106 in West Bridgewater, and Plymouth Street in Bridgewater during passbys of the

Cape Cod passenger trains at different times of day. In no case was a gate closure period longer than 90 seconds recorded.

At several locations, trains stopped in a station to pick up and discharge passengers will need to block adjacent streets for the dwell time duration. These locations are Birch Street at the Abington Station and Commercial Street at the Weymouth Landing Station. The estimated maximum street blockage time at these locations is two minutes.

- The average arrival rate per crossing closure on both sides of the track (or relevant side of the intersection, using the existing signal cycle) was calculated from Peak Hour flows for both peak hours.
- Maximum arrival rates during a crossing closure were estimated by assuming random arrivals (a conservative assumption in areas of moderate-to-heavy traffic), and applying the Poisson formula to derive 95th-percentile arrivals, which were rounded up to the nearest vehicle. For arrival rates of approximately 3 to 15 vehicles per closure-period, the 95th percentile arrival rate is 5 or 6 vehicles higher than the average.
- An average of 22 feet per vehicle was assumed to estimate the length of vehicle queues. Maximum queue lengths were compared with the distance to nearby intersections to determine whether conflicts were likely to occur. Since the chances that a "maximum arrival rate" period will coincide with a train passby/gate closure are low, this was believed to be a reasonably conservative method of predicting where queue back-ups into adjacent intersections are likely to occur more than infrequently. However, at locations where even a minimal probability of queue backups was judged to be unacceptable-- notably at South Hanson and Plymouth Street in Bridgewater--intersection signalization with pre-emption was proposed as a mitigating measure.
- Average delay for a stopped vehicle at each grade crossing was estimated at one-half the grade crossing duration (45 seconds for simple pass-by), plus the vehicle start-up time for the median vehicle in the queue when the gates go up, assuming 2 seconds start-up time per vehicle. Thus, for a queue which grows to 10 vehicles when the gates are released, the average delay is 45 seconds plus 10 seconds (2 seconds each for the first 5 vehicles in the queue), or 55 seconds.

TABLE B-1

Level-of-Service Criteria for Signalized Intersections

Level of Service	Stopped Delay per Vehicle (sec.)
A	<5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	>60.0

Source: 1985 Highway Capacity Manual, Table 9-1

C. MITIGATING MEASURES

Measures available to mitigate traffic impacts include:

- Simple retiming of existing traffic signals,
- Installation of new traffic signals, with or without railroad pre-emption,
- Channelization or pavement marking to designate left-turn lanes at station entrances and elsewhere; minor widening of intersection approaches,
- Redesign of intersections or streets to alter existing circulation patterns,
- Major reconstruction of streets and highways.

Mitigation measures were proposed at locations where:

- The proposed station itself would generate traffic creating delays or congestion at specific locations; or,
- The station would generate minor amounts of traffic, but can not operate efficiently and safely unless improvements are made to already-constrained locations.

At this stage of the project, measures were proposed and analyzed based on their ability to add capacity to station- area streets. It was assumed in the design of specific improvements that property-taking should be kept to a minimum: to the extent possible, all improvements are proposed to take place within existing public rights-of-way.

In addition, proposed improvements have not been reviewed with the relevant Town Engineers in most cases. This document is meant in part to spark this discussion with individual towns; and the suggestions or recommendations included herein are subject to change based on such discussions.

Plans for the specific mitagation measures are contained in Chapter IX of the DEIR/DEIS: Conceptual Plans. the following plans are shown therein:

LIST OF INTERSECTION IMPROVEMENT DRAWINGS

IX-C#	
1	Braintree: Pearl, Hancock and Washington Streets
2	Braintree: Hancock, Plain and Washington Streets
3	Holbrook-Randolph: Union, Mill and Center Streets
4	Montello: Winter, Howard and Spark Street (two sheets; 4a and 4b)
5	Brockton: Crescent and Montello Streets
6	Campello: Montello Street and Riverside Avenue
7	Campello: Plain Street and Riverside Avenue
8	Bridgewater: Summer Street and Station Driveway
9	Bridgewater: Plymouth and Summer Street
10	Lakeville: Main Street (Route 105) and Station Driveway
11	South Weymouth: Route 18, Route 58, and Pond Street (four sheets; 11a through 11d)
12	Abington: Birch Street and Station Entrance
13	Abington: Plymouth Street (Route 105) and Station Driveway
14	Abington: North and Birch Streets
15	Whitman: Pleasant, South and Franklin Streets
16	Hanson: Main Street at Station Entrance
17	Halifax: Holmes Street and Garden Road
18	Kingston Evergreen Street and Summer Street (Route 3A) (two sheets; 18a and 18b)
19	Weymouth Landing: Commercial Street and Station entrance
20	East Weymouth: Commercial Street and Hawkins Street
21	West Hingham: Fort Hill Street and Station Driveway
22	West Hingham: Fort Hill and West Streets
23	Hingham Square (three sheets; 23a, 23b, and 23c)
24	Nantasket Junction: Justice Cushing Way and Summer Street
25	Hingham: Hull and East Street
26	Cohasset: Justice Cushing Way and Station Driveway
27	Cohasset: North Main Street and Station Dropoff
28	Cohasset Village
29	North Scituate: Country Way, Gannett Road, and H.T Bailey Road
30	Greenbush: Justice Cushing Way and Driftway
31	Greenbush: Driftway and Old Driftway

D. IMPACTS BY GEOGRAPHIC AREAS

1. Regional

Transportation impacts on a regional scale are discussed in Chapter IV of the DEIR/DEIS: Transportation Impacts.

2. Line Segments from South Station to Columbia Road.

3. Line Segment from Columbia Road to Hancock Street, Quincy.

4. Line Segment from Hancock Street to Quincy-Braintree Line.

No station traffic or grade crossing traffic impacts have been analyzed in the above three segments because no line stations or grade crossings are proposed in these segments.

5. Braintree Station and Line Segment from Quincy-Braintree Line to South Braintree Junction

This segment runs from the Quincy-Braintree town line to So. Braintree Junction. The three Old Colony branches are all on the same track at the northern end of this segment, with the Greenbush branch taking off south of Elm Street. The other two branches stay together until South Braintree Junction, where the Middleborough and Plymouth branches diverge.

Traffic impacts in this section are concentrated in the vicinity of the existing Red Line Station, where the proposed commuter rail station would also be located. In addition, the Pearl Street grade crossing is included in this section, because this crossing involves both the Middleborough and Plymouth Lines. Other grade crossings within Braintree are discussed in subsequent chapters.

The Old Colony proposal as it affects this segment will include operation of peak-period commuter service on approximately 30-minute headways on both the Middleborough and Plymouth Lines, with approximately 2-hour headways during daytime off-peak hours. The Braintree commuter rail station would be located just to the north of the existing Braintree Red Line Rapid Transit station, but using the same access system, drop-off bays, and parking. No additional parking is assumed to be provided at the existing station to service the commuter rail operation.

5a. Streets and Intersections

The principal streets in the vicinity of the proposed station are Ivory Street and Washington Street, providing north-south access, and Union and Pearl Streets, providing east-west connections.

Ivory Street as it currently exists was built to accommodate the Red Line station and garage. It is generally 2 travel lanes in each direction, with turning lanes provided at key points, including the station entrance and its intersections with Union and Pearl Street.

Washington Street is the principal street through the Braintree Central Business District. It operates as one travel lane in each direction, with room at intersections for through traffic to bypass left turns. South of Plain Street, Washington Street becomes Route 37, the major north-south arterial providing connections with Routes 3 and 128 for towns south of Braintree.

Union Street, which provides direct access to Route 3, was widened and improved in conjunction with construction of the Red Line station in the 1970s. Union Street is currently 2 general travel lanes wide in each direction, but with exclusive turning lanes in both directions at its intersection with Ivory Street. West of the overhead railroad bridge and approaching Washington Street, Union Street narrows down to provide two approach lanes to Washington Street.

Pearl Street between Washington and Ivory Streets is one travel lane in each direction, with abutting businesses and residences.

5b. Existing Volumes

Traffic counts performed by the consultants and obtained from other area studies provided information on existing area traffic patterns. The Braintree Red Line station is the major existing traffic generator in its immediate area, with arrivals primarily from the Southeast Expressway via Union Street, and from points within south Braintree, Holbrook, and other towns to the south via Route 37. Area volumes are moderate to high during peak hours, especially in the key travel corridors of Union Street, Washington Street, and Route 37.

The highest count volumes were observed at the Route 37/Hancock/Plain Street intersection--Route 37 NB (Hancock Street) carries a volume of 1550 in AM Peak Hour, including a large percentage destined for Route 128 via the Route 37 interchange.

Traffic volumes are lighter farther north along Hancock/Washington Street. Street activity is intense (on-street parking, pedestrian crossings, etc.) and capacity limited in this area (see Figure 5-1).

Level-of-Service Analysis of area intersections yielded an assessment of existing operations, as shown on Table 5-1. Generally, intersections tend to operate at LOS C or better, given existing traffic demand.

5c. Accident Experience

Town of Braintree Police Records were consulted to determine accident experience at intersections of concern near the proposed commuter rail station. Recorded accidents for Calendar Year 1986 at these locations are summarized in Table 5-2.

None of these totals is unusually high (the Town-wide recorded accident total for 1986 is 4,087); so that no especially hazardous locations can be identified close to the station site on the basis of recent reported accidents.

No pending roadway improvement projects were identified within the general vicinity of the station (apart from development-related mitigation measures). The Metropolitan Area Planning Council (MAPC) recently completed a draft traffic study for the Route 37 corridor in Braintree and Holbrook. The draft study includes among its recommendations the creation of a coordinated signal system along Route 37 between Plain Street and Route 139 in Holbrook, but no other Braintree site-specific improvements.

5d. Future Growth Assumptions

Quite a few development projects within Braintree are proposed for development within the next several years, and are in various stages of the Town approval process. These include, among others:

- a 141,000 sq. ft. shopping center on Pearl Street east of the grade crossing (F. X. Messina Enterprises);
- Tricon Park, an office/light industrial complex on Columbian Street at the Weymouth Town Line;
- a possible hotel/conference center (200-300,000 sq. ft.) abutting Route 3 north of Union Street; and
- additional office development (up to 1 million sq. ft.) close to the South Shore Plaza shopping Center.

Traffic studies prepared for several of these projects were available to us, and were used as sources of supplementary traffic data. However, because so much of the proposed development in Braintree is as yet unapproved by the Town, future (Year 2000) base traffic in the area was estimated using a growth factor based largely on population growth projections. These projections were also used to estimate Old Colony ridersnip under each of the line alternatives.

For Braintree, population growth is assumed to be essentially flat to Year 2000. However, a traffic growth figure of 1 percent per year overall, uncompounded, or 13 percent above existing conditions, was assumed to account for general development. The only development proposal explicitly included was the Pearl Street shopping center, which has already received its approvals and which would create a new driveway close to the grade crossing. Site-generated volumes and distributions as shown in the traffic impact study for that project were incorporated into the Old Colony rail proposal analysis.[1]

The resulting base traffic volumes, without a commuter rail station, are as shown in Figure 5-2. Level-of-Service analysis applied to these volumes with existing geometry yields results as shown in Table 5-1.

5e. Station Traffic

A Braintree commuter rail station would be located just to the north of the existing Red Line Rapid Transit station, east of Washington Street in

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[1] Traffic Impact Assessment, Pearl Street Shopping Center (BSC Consultants, June 1985).

Braintree. No additional parking would be provided at the existing garage, which would be available to commuter rail patrons as well as rapid transit riders. Consequently, the net addition of traffic associated with park-riders would be nil. However, some additional drop-off traffic would be generated by the commuter rail station.

Access to the new station would be via the same ramp/roadway systems that currently serve the Red Line station and garage.

Patronage forecasts for the Braintree station, by mode of access, were produced for four rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, the alternative which resulted in the greatest traffic addition to local streets was selected as a "worst-case" scenario. In this case, Alternative 3a, the Middleborough only full rail service alternative, with 158 daily drop-off patrons.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 96 vehicles in and out in each peak hour. The distribution of arrivals and departures is as shown on Figure 5-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using these streets. In fact, however, it is more likely that some station traffic, particularly Braintree resident traffic, is traffic which would otherwise use local streets to access Route 3 or Route 128 for an automobile trip to work.

In addition, no reduction in Braintree traffic volumes was assumed to account for Red Line park-riders who may switch to commuter rail stations closer to home; but some such diversion and traffic reduction would most likely accompany restoration of commuter rail service.

The total future traffic volumes of Figure 5-4 represent increases above base Year 2000 volumes of 2 to 5 percent, depending on location. Level-of-Service results for each intersection under future conditions are as shown in Table 5-1.

Both the Union/Ivory Street and the Washington Street/Pearl Street intersections will operate at Level of Service "C" during the AM Peak Hour, but at "E" during the PM Peak Hour. Their future operation is based primarily on the base traffic growth assumptions, and not on anticipated station traffic. Station traffic will add only minor volumes to base traffic.

5f. Grade Crossings

There are six grade crossings in Braintree, two of which (Pearl Street and Plain Street) are on the Middleborough Line. The Pearl Street crossing is discussed here and the Plain Street crossing is addressed in Section 6, which covers the Middleborough line between South Braintree Junction and the Holbrook-Randolph station.

The combined Middleborough-Plymouth Line grade crossing on Pearl Street is located 680 feet east of Washington/Hancock Street, and 1,080 feet west of Ivory Street. Both Washington/ Hancock Street (north-south) and Pearl/ Washington

Street (east-west) exhibit strong peak-hour directionality (64 percent northbound AM, 62 percent southbound PM on Washington/Hancock; 64 percent westbound AM, 66 percent eastbound PM on Washington/Pearl Streets). Traffic in the area is quite steady during both peak hours, without sharp surges or volume drop-offs peak period conditions begin before, and persist after, the technical peak hour.

1) Queues at the Track

Both Middleborough and Plymouth Line trains would cross Pearl Street at this location. For present planning it is assumed that as many as 6 train passbys may need to be accommodated during the AM peak hour, with the same number in the reverse direction during the PM peak. Trains on the two lines would alternate, with an estimated 5 minute minimum separation between a Plymouth train arrival and a Middleborough arrival during the peak hour. This is the only location on the Old Colony line expected to experience such frequent passbys.

Because commuter trains passing through this area will be operating at slow speeds (less than 25 mph), the maximum likely duration of a grade crossing closure would be about 90 seconds. A train passby and resulting gate closure would create conditions equivalent to locating a traffic signal at the grade crossing location with a 90-second "red" indication for Pearl Street traffic, appearing at intervals ranging from 5 to 20 minutes.

Assuming single-lane approaches on both sides of the tracks and traffic volumes as shown on Figure 5-4, vehicle arrival rates at the Pearl Street crossing during a 90-second interval will be as shown in Table 5-3. The PM Peak Hour Westbound estimates include traffic generated by the proposed shopping center--an increment of 240 vehicles above otherwise-projected totals.

None of these maximum queue lengths stretches into the next signalized intersection, although Pearl Street driveways, including the new shopping center driveway, would be blocked during a train passby.

The average delay to a stopped vehicle is half the gate closure time (45 seconds), plus a start-up delay time of 2 seconds per vehicle for the median vehicle in the queue; or about 70-75 seconds overall.

During the start-up delay period on each approach, additional vehicles join the rear of the queue--about 10 additional WB vehicles in the morning, and 14 additional WB vehicles in the evening, which would be delayed by the discharging queues but not stopped by the grade crossing.

The entire cycle, from the beginning of gate-closing to the resumption of normal flows on Pearl Street, would require less than three minutes in the extreme worst case. For the situation in which a 5-minute minimum headway between trains occurs, that period of time will just be sufficient for one queue to discharge before the gates come down and a second queue starts to form.

The percentage of peak hour vehicles stopped and delayed by train passbys, given a) the average arrival rates, b) an anticipated maximum passby duration of 90 seconds, and c) 6 passbys in the peak train hour, is 15 percent.

2) Queues at Signalized Intersections

The same sort of analysis applies at the intersections on either end of Pearl Street; viz., at Washington and Ivory Streets. Signal permits for the traffic signals at both locations are appended. They show maximum cycle lengths of 111 seconds and 85 seconds respectively, including pedestrian phases, at the Ivory and Washington Street signals. Pedestrian volumes at Ivory/Pearl Street are negligible. The cycle length here excluding pedestrian activation is 90 seconds. Both signals are actuated, and the maximum phase lengths are very rarely used.

In addition, at both intersections the opportunity exists for vehicles to queue in 2 lanes. Two full lanes are designated at the Pearl Street EB approach to Ivory Street for a distance of about 70 feet. Two lanes typically form at the Pearl Street WB approach, even though this approach is not striped for 2 lanes.

3) Pearl/Washington Street Intersection

The critical approach/time of day at Pearl/Washington Streets is WB in the AM Peak Hour, when the approach volume is estimated at 633 vehicles. The maximum red-yellow interval faced by WB traffic at this intersection is 55 seconds of the 85 second cycle, including a pedestrian activation phase. Average peak hour vehicle arrival rate in 55 seconds is 10 vehicles. Maximum likely arrival rate is 15 vehicles, for a maximum queue length of 330 feet, about half the distance back to the track, assuming a single-lane queue.

Pearl Street is wide enough for 2-lane queues at this intersection for several car lengths, and 2-lane queues were observed at the signal. Consequently, the likelihood of a queue extending back as far as the track is even less.

4) Pearl/Ivory Street Intersection

Traffic turning right into Pearl Street EB from the proposed shopping center to the Pearl Street approach at Ivory Street was estimated, in the traffic study performed for that project, as a net addition of 360 vehicles in the PM Peak Hour. The total future Pearl Street EB approach volume at Ivory Street under this assumption is 1164 vehicles.

At the existing traffic signal, Pearl Street EB faces a yellow or red indication for a maximum of 45 seconds under fully- loaded conditions. Average vehicle arrival rate per 45-second period is 15 vehicles; maximum likely arrival rate is 20 vehicles. This gives a maximum single-lane queue length of 440 feet; because 2 lanes are available for about 70 feet--room to store 3 cars--this length is actually closer to 375 feet, which again falls well short of the distance to the grade crossing (1,080 feet). Again, there is little danger of queues from the intersection backing across the track.

5g. Driveway/Street Blockage

The following streets and industrial/commercial driveways would experience short-term blockage during train passbys at Pearl Street:

- Sigma Corporation has several driveways on Pearl Street. Driveways closer to Ivory Street will be available during most of crossing duration.

- New shopping center driveway - a secondary access on Ivory Street was originally considered and may be desirable given the location of the Pearl Street driveway close to the track.

- French Street west of the track provides access to Pearl for residential neighborhood. Alternative access via Washington Street is available if necessary during periods when Pearl Street gates would be closed.

- McDonald's and other business/residential driveways. Eastbound access and egress would be limited during gate closure.

5h. Mitigation Measures

The following traffic measures are recommended:

- Pearl Street grade separation. Pearl Street would pass under the tracks. The access to the shopping center could be maintained, but French Street access to Pearl Street would not be provided.

- Washington/Pearl Street intersection--striping of Pearl Street WB approach for 2 lanes back for approximately 200 feet from Washington, with elimination of on-street parking from the north side of Pearl Street, east of Washington Street. This may require minor widening on north side of Pearl Street, which will partially encroach upon existing sidewalk. (DEIS, Chapter IX, Figure IX-C1.)

- Provision of a 2-lane approach would permit intersection operation at Level of Service "C" in both peak hours given future volumes with or without a station.

TABLE 5-1

Level of Service Analysis: Braintree Station Area

Intersection	Currently Signalized?	Level of Service: Year 2000 Traffic — Existing Traffic AM	Existing Traffic PM	without OC commuter station AM	without OC commuter station PM	with OC commuter station AM	with OC commuter station PM
Union/Ivory St.	YES	B	C	C	E	C	E
Ivory/Pearl St.	YES	B	B	B	C	C	C
Washington/Pearl St.	YES	B	B	C	E	C	E

TABLE 5-2

Accident Incidence from Braintree Police Records

Intersection	Number of Recorded Accidents, 1986
Ivory at Union St.	5
Ivory at MBTA Station entrance	3
Pearl at Ivory St.	10
Pearl at Washington St.	1
Pearl at French St.	1

TABLE 5-3

Queuing Analysis: Pearl Street Grade Crossing

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Dist. to Nearest Sig.Int. (ft.)
AM Peak Hour					
Pearl EB	365	9	14	310	680
Pearl WB	770	19	24	530	1080
PM Peak Hour					
Pearl EB	843	21	26	570	680
Pearl WB	687+240*	23	28	615	1080

*shopping center traffic

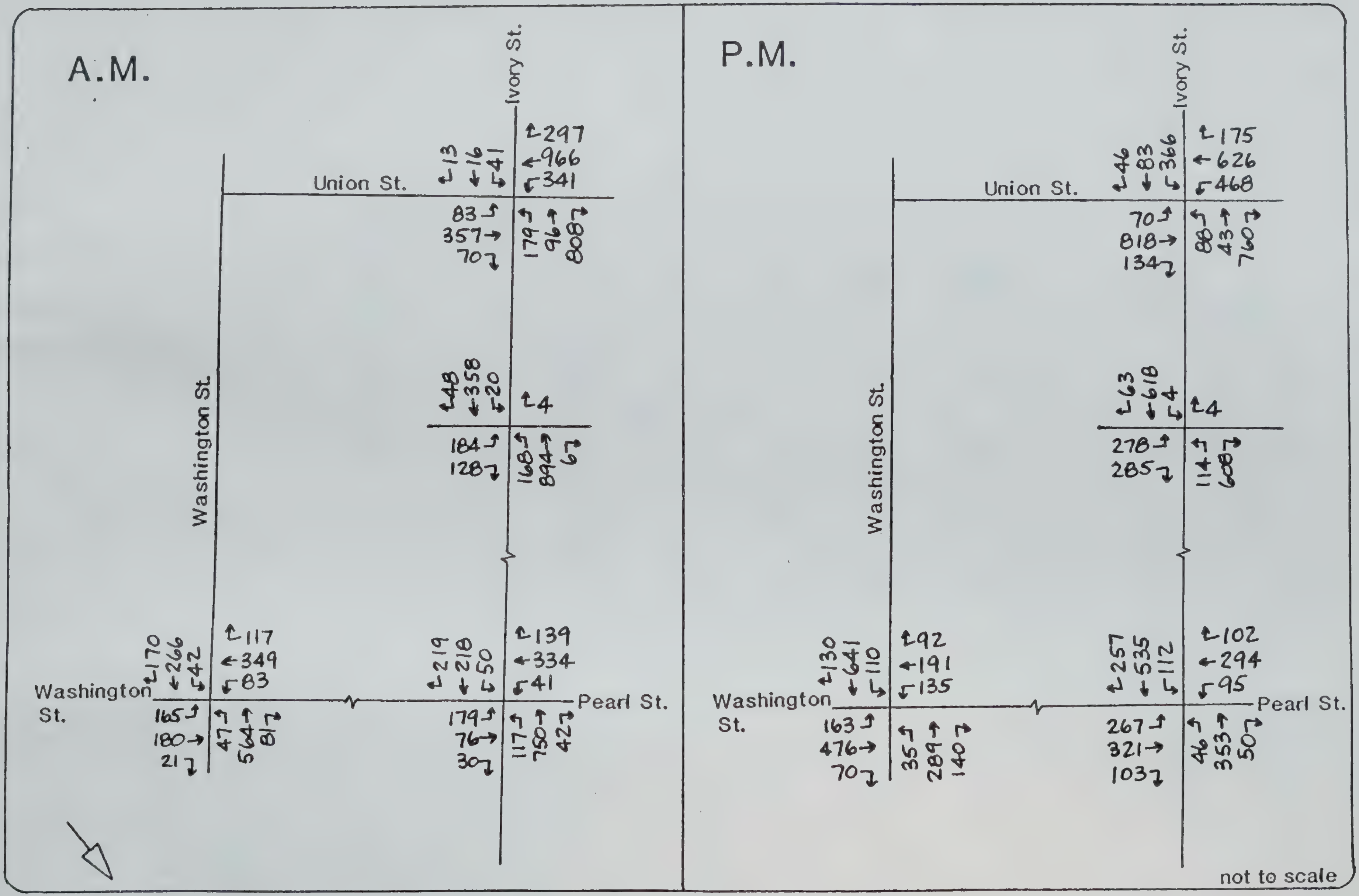

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FIG. 5-1
BRAINTREE: EXISTING TRAFFIC

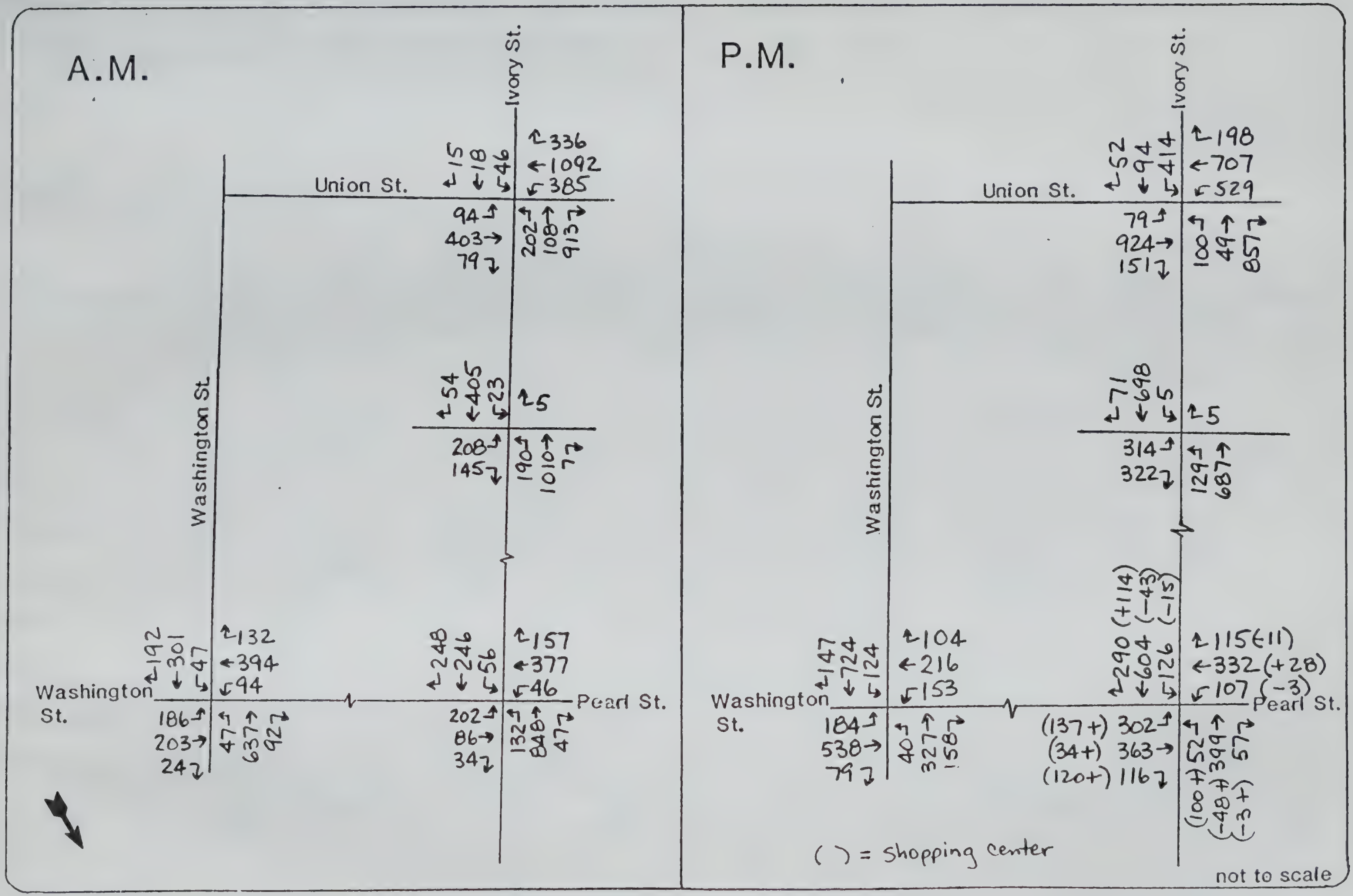

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FIG. 5-2
BRAINTREE : YEAR 2000 BASE TRAFFIC

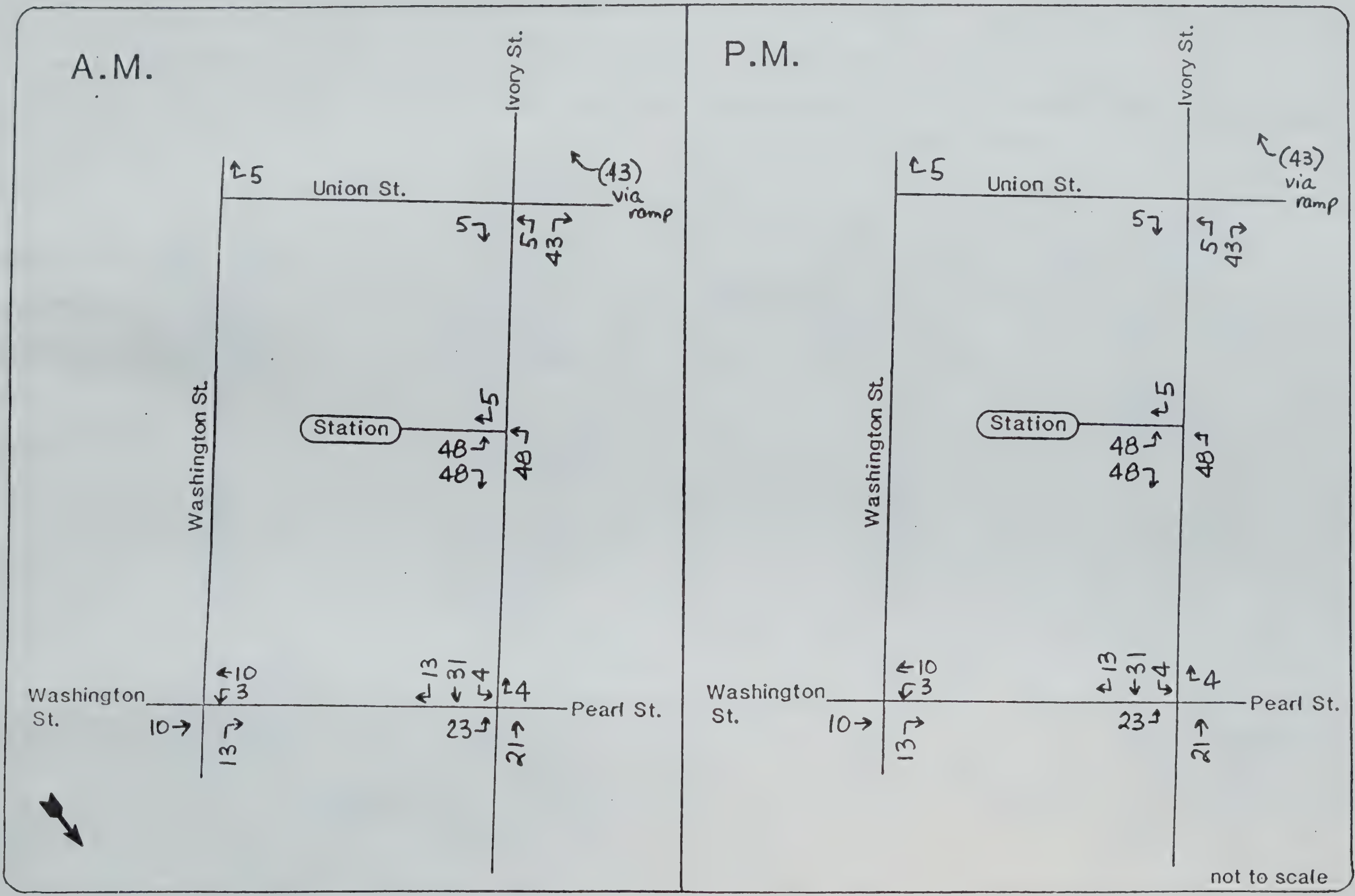

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FIG. 5-3
BRAINTREE: STATION TRAFFIC

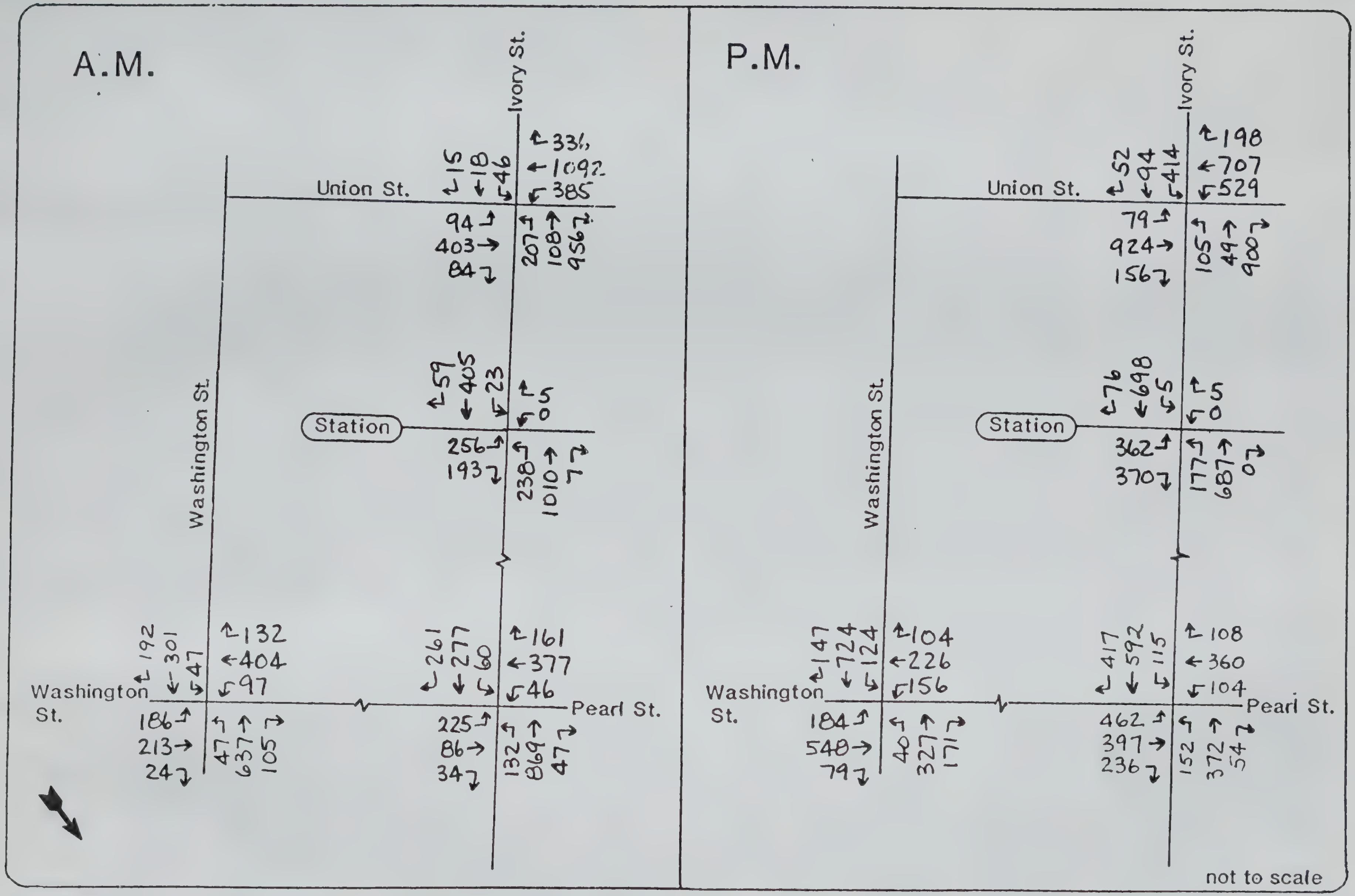

FIG. 5-4
BRAINTREE: FUTURE TRAFFIC, WITH STATION

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6. Braintree Line Segment from South Braintree Junction to Braintree-Randolph Line on Middleborough Line

This segment runs from the South Braintree Junction to the Braintree-Randolph Town Line, on the Middleborough Line. The primary street traffic impact within this section would occur at the grade crossing at Plain and Hancock Streets.

6a. Streets and Intersections

Plain Street is a suburban arterial street serving residential Braintree neighborhoods. It travels as one lane in each direction for most of its length, but 2 approach lanes are provided for a distance of about 180 feet back from Washington Street (i.e., back to Garden Park).

Hancock Street is a major north-south arterial, designated Route 37 south of Plain Street. The Route 37 designation shifts to Washington Street, north of Plain Street. Route 37 provides direct access to the commercial areas of North Braintree and to Route 128. Both the Hancock SB and Washington EB approaches to the Plain Street intersection have 2 lanes. Hancock Street NB has 3 approach lanes, including a left-turn lane and a lane which serves as a right-turn lane, although it is not so marked.

Route 37 from Plain Street, Braintree, to Union Street, Holbrook, has recently been the focus of an MAPC/CTPS corridor planning study, which investigated the feasibility of narrowing the vehicular right-of-way and widening sidewalks in Braintree. ("Route 37 Traffic Study" (Draft), Metropolitan Area Planning Council/Central Transportation Planning Staff, May 1987). That study found that the Plain/Washington/Hancock Street intersection currently operates at an adequate Level of Service (C/D), and did not recommend any specific improvements for this area.

The Middleborough Line grade crossing at Plain Street is located immediately adjacent and parallel to Hancock Street at its intersection with Washington Street. This intersection is governed by an actuated traffic signal with 4 traffic phases plus a pre-emption sequence for railroad operations. The pre-emption sequencing is as shown on the current signal permit, appended. Railroad pre-emption is currently activated by freight and Cape Cod trains operating on the Middleborough Line.

6b. Existing Volumes

This intersection has been studied numerous times during the past 3 years, in connection with several nearby development projects, as well as for the MAPC/CTPS and Old Colony Rail studies. Existing traffic volumes based on averages of these counts are illustrated in Figure 6-1. Flows are fairly constant, without sharp peaks (Peak Hour Factor = .93-.95).

The primary characteristic of this location is the heavy turning movements, particularly left- and right-turns from Hancock St. NB, and the corresponding right- and left-turns from Washington and Plain Streets. Traffic is very directional here, heavily northbound in the morning and southbound in the afternoon. The intersection currently operates adequately, however, with acceptable delays to all moves.

6c. Accident Experience

Town of Braintree Police Records were consulted to determine accident experience at intersections at or near this intersection. A total of 2 accidents at this location were recorded for Calendar Year 1986, of a Town-wide total of 4,087. This intersection would not appear to represent a particularly hazardous location.

6d. Future Growth Assumptions

The principal projects likely to affect this location if approved, in addition to the Old Colony Rail Project, include those described in the discussion of the proposed Braintree Station (Section D5 above).

Of these, the Tricon Park development, and any additional approved development on Route 37 near Route 128, will tend to generate vehicular traffic which will affect the Plain/ Washington/Hancock Street intersection. The Tricon Park DEIR explicitly included this intersection in its analysis, anticipating under its Maximum-Build scenario that 302 vehicles would be added in the AM Peak Hour and 340 in the PM Peak Hour. The heaviest additions of development volumes tend to be added to non-critical moves (e.g., EB from Washington during the AM Peak); but these still represent substantial increases over existing traffic volumes at an already-busy location.

6e. Base Traffic Growth

For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 1 percent per year, were computed and are presented in Figure 6-2. These did not explicitly include the Tricon project; however, differences in conclusions, resulting from the full Tricon project, are noted on Figure 6-3 and in the analysis discussion below.

Given these growth levels, the future Level of Service at the intersection will be:

	Level of Service	
	AM Peak Hour	PM Peak Hour
2010 Without Tricon (1%/year growth)	D	E
1992 Tricon maximum (build assumption)	D	E

These Service Levels represent future patterns with or without a commuter rail station at Braintree, since such a station, without additional parking, will add negligible traffic volumes to this area. The primary effect of Old Colony rail operations here will be more frequent activation of the existing Plain Street grade crossing.

6f. Grade Crossings

A similar analysis to that described at Pearl Street was undertaken for the Plain Street grade crossing, to determine queue lengths and average delays associated with grade crossing closure. Plain Street differs from Pearl Street because the grade crossing is located adjacent to the stop line, very close to the intersection. Consequently, traffic signal pre-emption is already required, and exists, at this location. Essentially, the normal 4-phase operation is interrupted to allow Plain Street WB to clear when an approaching train is detected.

1) Queues at Intersection

With Old Colony commuter service through this built-up area, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. The schedule currently envisaged calls for half-hour commuter-train headways on the Middleborough Line during peak hours, with other activities (freight, Cape trains) restricted to off-peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

On Plain Street WB, the critical arrival period is the AM Peak Hour. Average vehicle arrival rate per 90-second gate closure under Year 2000 volume assumptions is 24 vehicles, with a maximum (95th percentile) arrival rate of about 30 vehicles. This would result in a vehicle queue of 530-660 feet, if queued in a single lane. In fact, however, vehicles will queue in 2 lanes for at least 180 feet, back to Garden Park; so that the actual maximum length of queue will be around 350 feet on average, and 480 feet in the "worst-case" arrival condition.

With an assumed start-up delay time of 2 seconds per vehicle, the average delay per stopped vehicle will be approximately 45 + 16 seconds, or just over a minute. This represents a delay of about 1 signal cycle.

In the PM Peak Hour, the average arrival rate on Plain Street would be about 18 vehicles per 90-seconds, with a maximum (95th percentile) rate of about 24 vehicles. The resulting vehicle queue would extend a distance of about 220 to 350 feet back from the stop line. The average delay per stopped vehicle in this case is 45 + 10 seconds, or just under a minute.

Other approaches would experience queues and delays primarily to affected movements (e.g., right turns from Hancock St. NB across the tracks), as shown on Table 6-1. Because multiple lanes exist on all approaches, it is possible to adjust the pre-emption phasing so as to minimize the impact to those movements which do not require crossing the tracks. This would require designating an exclusive left-turn lane on the Hancock Street SB approach, and the widening of this approach to provide an additional through-right turn lane.

On Washington Street EB, there is not sufficient room to provide 2 full approach lanes far enough back from the intersection to allow free movement of right-turning traffic around queued through-left-turn movements. The estimates of queuing length shown in Table 6-1 assume that all movements from this approach are stopped by a train passby during the critical PM Peak Hour (except that a maximum of 10 cars are assumed able to turn right before blockage occurs). PM Peak Hour queues on this approach will extend well beyond the Dunkin Donuts driveway in that event; and some vehicles may seek alternative routes to Hancock Street SB upstream of the Plain Street intersection.

The total time from signal pre-emption to resumption of normal traffic flows is anticipated to be less than 2 minutes.

2) Driveway/Street Blockage

The primary streets/driveways which will experience short-term blockage during peak hours as a result of train- passby-related traffic queues on Plain Street include:

- The Armstrong Corporation driveway on Plain Street. Armstrong has a second driveway on Ivory Street, so that alternative access is available.

- Garden Path, a minor street providing access to commercial/light-industrial establishments. Garden Path provides the only existing access to these establishments, so that vehicles approaching or leaving this area will be delayed about 1.5 minutes 3 times during each peak hour.

On Washington Street:

- The Dunkin Donuts driveway on this side will be blocked to left-turning outbound traffic, particularly during the PM Peak Hour. Vehicles bound for Route 37 SB towards Holbrook can make this move more easily from the Hancock Street exit; but Plain-Street-bound traffic will be delayed. Right-turning traffic from the Washington Street side will not be affected.

6g. Mitigation Measures

The following traffic measures are recommended:

- Existing grade crossing controls--upgrading of existing gate controls.

- Traffic signal--review existing signal installation; retime if necessary. Insure adequate operation of pre-emption sequencing. Adjust phasing to permit through SB and NB moves and Washington Street right turns to proceed while pre-emption is activated. (Existing phasing for non-pre-emption sequencing appears to be appropriate for future traffic conditions).

- Street improvements--widen Hancock Street SB approach to provide 2 through lanes plus an exclusive left-turn lane. This will allow through and right-turn SB movements to proceed while left-turns are stopped for train passbys. (See DEIS Chapter IX, Figure IX-C2.)

TABLE 6-1

Queuing Analysis: Plain Street Grade Crossing

Location	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Plain St. WB					
--1% growth assumption					
AM Peak Hour	938	24	30	480*	61
PM Peak Hour	712	18	24	350*	55
--Tricon assumption (1992)					
AM Peak Hour	958	24	30	480*	61
PM Peak Hour	949	24	30	480*	61

*2 lanes available for 180 feet

Location	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
2. Washington St. EB--through/left turn movements					
--1% growth assumption					
AM Peak Hour	165	4	8	175	49
PM Peak Hour	553	14**	18**	570	71
--Tricon assumption (1992)					
AM Peak Hour	344	9	13**	285	54
PM Peak Hour	532	13**	17**	510	63

**at this density, right-turn traffic will also be blocked; queue length estimation reflects assumption that first 10 right- turns are not blocked, but all other movements queue in a single lane for the entire distance.

Location	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
3. Hancock St. SB--left turns into Plain					
--1% growth assumption					
AM Peak Hour	54	2	6	130	47
PM Peak Hour	170	4	9	200	49
--Tricon Assumption (1992)					
AM Peak Hour	104	3	8	175	48
PM Peak Hour	191	5	10	220	50

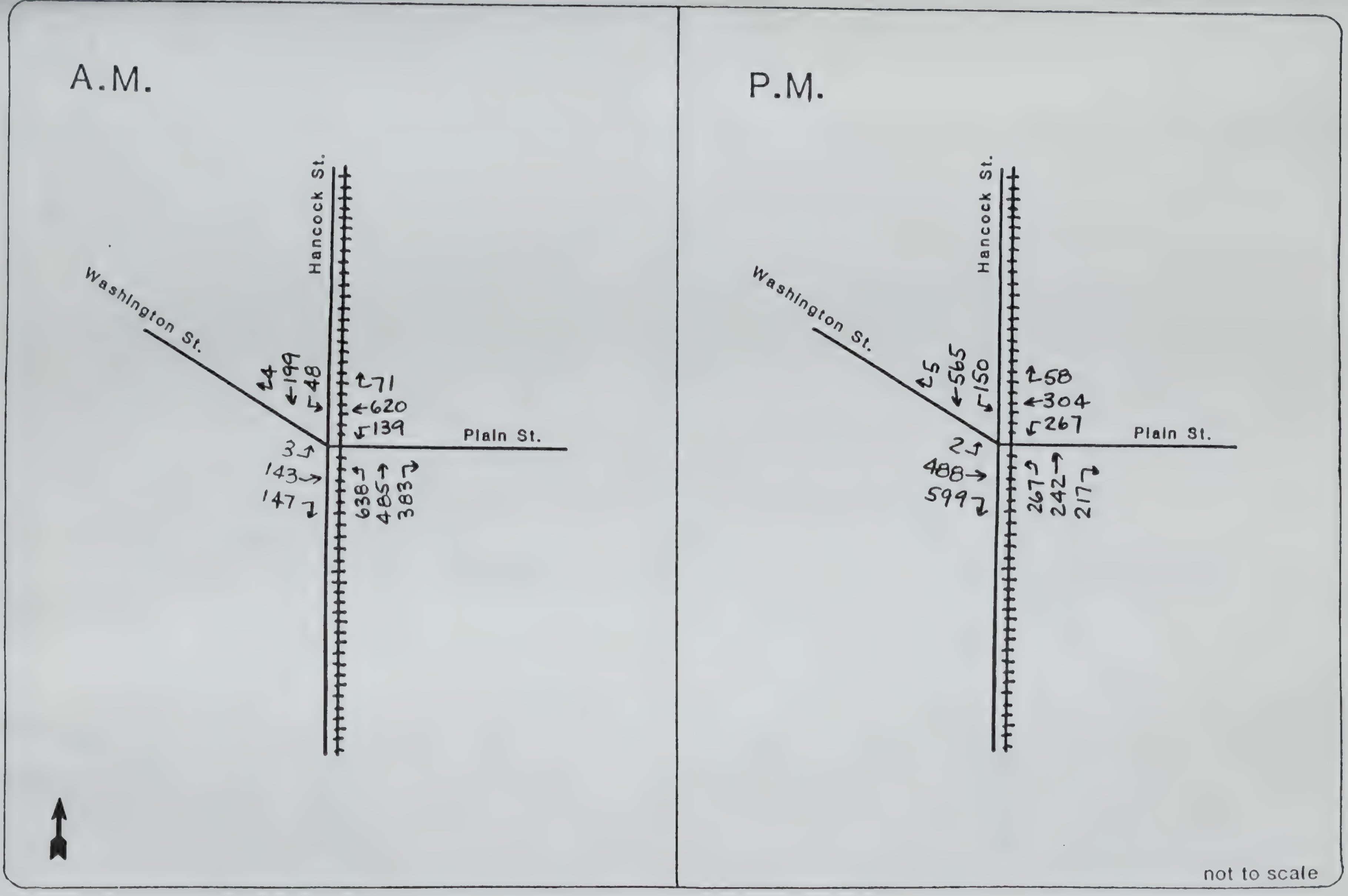

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FIG. 6-1
BRAINTREE (PLAIN ST.)
EXISTING TRAFFIC VOLUMES

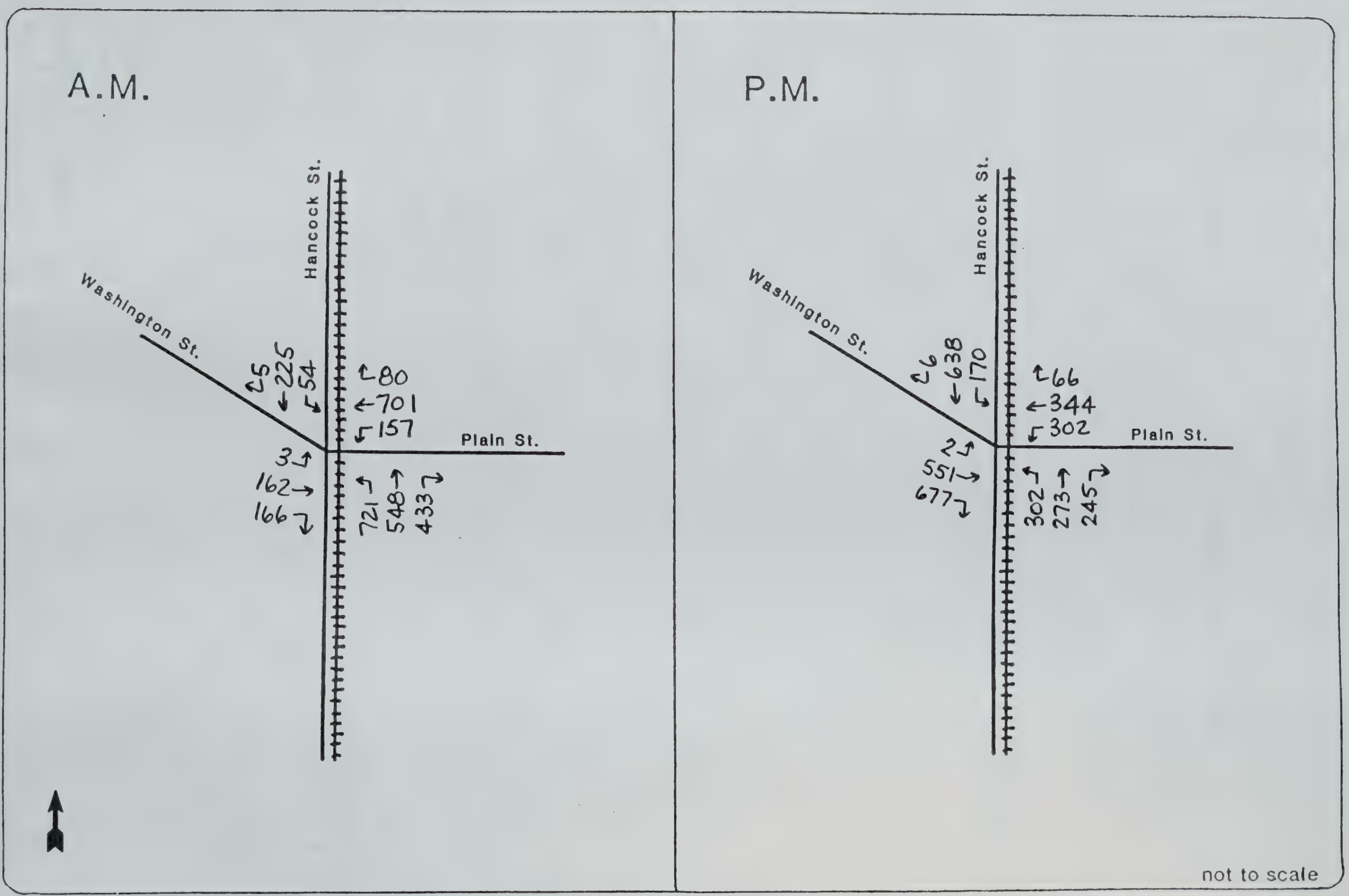

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FIG. 6-2
BRAINTREE (PLAIN ST)
YEAR 2000 BASE TRAFFIC

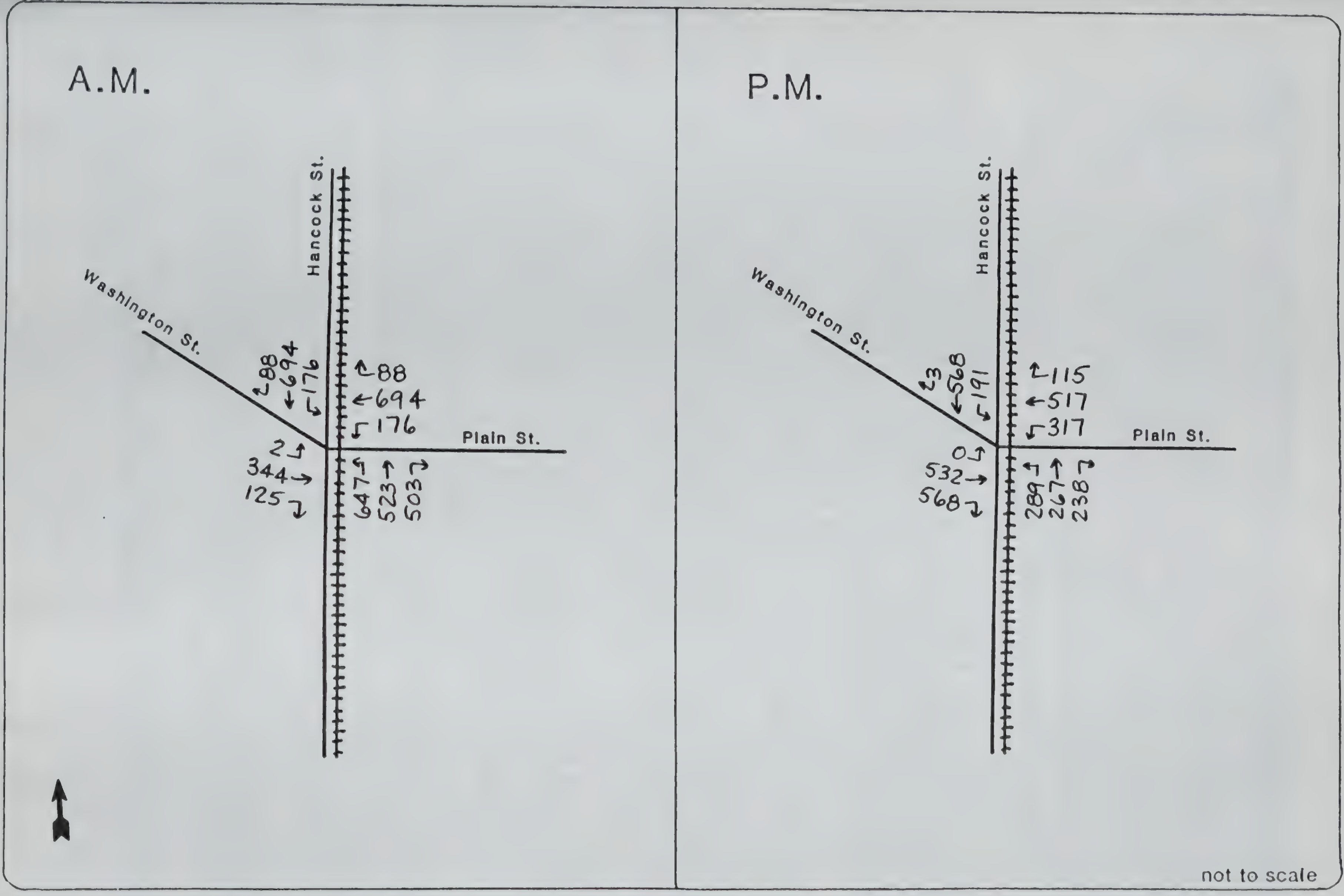

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FIG. 6-3
BRAINTREE (PLAIN ST.):
TRICON PARK – 1992 TRAFFIC ESTIMATES,
w/ MAXIMUM DEVELOPMENT

7. Holbrook-Randolph Station and Line Segment from Braintree-Randolph Line to Avon-Brockton Line

This segment extends from the Braintree-Randolph Line to the Avon-Brockton Line, on the Middleborough Branch. It includes a proposed Holbrook-Randolph station, to be located on Union Street, Holbrook, at the Holbrook-Randolph Line. In addition, there are 4 grade crossings on this section: at Union Street, South Street, High Street, and Spring Street, all in Holbrook.

7a. Streets and Intersections

The principal street providing access to the proposed station site is Union Street (Route 139) in Holbrook and Randolph.

Union Street is an E-W arterial route connecting the towns of Stoughton, Randolph, Holbrook, Abington, and Rockland. It has a paved width of approximately 30 feet close to Mill/ Center Streets, and travels as one lane in each direction, with flared intersection approaches. The area near the White Hen Pantry at Mill/Center Streets has a channelization island separating right-turn moves from Union Street; but there is no curbing to separate the White Hen parking area from the travel way. A similar lack of curbing definition exists at the station parking lot. Union Street itself is heavily-traveled, with a maximum 2-way volume of about 1800 vehicles (two-way) in the PM peak hour.

Approximately 1 mile east of Mill/Center Streets, the next major Union Street intersection (Holbrook Square, the intersection of Union and Franklin Street (Route 37), Holbrook) is signalized. This intersection was given special attention in the recent MAPC/CTPS Route 37 Corridor Planning Study, because of local concerns about existing congestion.

West of the station site, Crawford Square in Randolph -the intersection of Union, North, and North/South Main Streets (Route 28) - is currently unsignalized. This location is the junction of 2 major routes which meet at the crest of a vertical curve. It has previously been proposed for greater traffic control in response to congestion and accidents.

The proposed station location at the intersection of Union Street and Mill/Center Streets is also unsignalized. Union Street has a sharp horizontal curve around steep ledge at this location, adjacent to the proposed station parking lot. This results in partially-obstructed sight distance looking west along Union Street from Mill Street.

7b. Existing Volumes

Traffic counts performed by the consultants and obtained from the MAPC/CTPS study provided information on existing area traffic patterns. Traffic count data were assembled, annualized and balanced to produce Existing Traffic Volumes, as illustrated on Figure 7-1.

As illustrated, existing traffic on Union Street is strongly directional: 70 percent of total volume is westbound in the morning peak hour, while 63-67 percent of total volume is eastbound in the PM peak hour. The intersection of Mill/Center Streets is characterized by heavy turning movements, particularly right turns from Center and left turns into Center during both peak hours. These turns reflect the importance of Center Street as a bypass of Crawford Square for NB/SB Route 28 traffic, as well as some smaller traffic volumes with origins or destinations on Centre Street itself.

To our knowledge, there are no existing plans to signalize Union Street/Mill/Center Streets. However, current and anticipated high traffic volumes and heavy turning movements at this location probably would meet signal warrants irrespective of whether a station is located here. This is also the case with Crawford Square in Randolph.

7c. Accident Experience

Accident records of the Holbrook and Randolph Police Departments were consulted to determine accident experience at the principal intersections in the area of the proposed station. Recorded accident totals for 1986 and January-June 1987 are summarized in Table 7-1 below. "Accidents" generally includes vehicular incidents which are reported to the police, generally involving a minimum dollar damage criterion.

Such accident statistics are difficult to interpret without calculating rates based on total annual intersection traffic. For the 2 Randolph locations, an estimated annual accident rate per million vehicles entering the intersection was calculated, using the assumptions that: a) Peak Hour volumes are 10 percent of Average Weekday Daily Traffic (AWDT) and b) annual entering volume is 300 times AWDT. The resulting accident rates, shown in Table 7-1, were compared with the statewide annual average accident rates per million entering vehicles for signalized and unsignalized intersections, estimated by CTPS (1.89 and 0.95 respectively).[1]

Only the Randolph intersections were examined in this fashion. Holbrook Square was omitted because a more precise analysis was done in the MAPC/CTPS study, focusing on the intersection itself. The Holbrook Square rate calculated in that study (0.33 accidents per million entering vehicles) compares quite favorably with the statewide average of 1.89.

Obviously, Crawford Square emerges as a local problem area, with more than 1 accident per week on average.

Individual accident reports for January-June 1987 were made available to us by the Randolph Police, from which a breakdown of accidents at Crawford Square was prepared, as shown in Table 7-2.

Almost two-thirds of the recorded accidents from this period involved angle collisions. Most of these involve unrestricted turning vehicles, suggesting that provision of improved traffic control with provision for segregated left-turn moves would probably reduce accidents at this location.

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[1] CTPS Technical Report 54a, Draft Route 9 Corridor Planning Study: Short-Range Element, January 1986.

7d. Future Growth Assumptions

The Planning Boards of Holbrook and Randolph were consulted to identify any major new development projects proposed or approved in the vicinity of the proposed station site. This area is already more densely developed than towns to the south, but some opportunities exist for new growth.

The Center Street area in Holbrook was identified as one area currently experiencing new development, including approximately 180,000 sq. ft. of office condominiums, and about 100,000 sq. ft. of warehousing.

To account for future growth in locally-generated and through traffic, a growth factor of 1 percent per year uncompounded, or 13 percent overall, was applied to 1987 traffic volumes. The resulting Base Year 2000 traffic volumes are as shown on Figure 7-2.

Level of Service Analysis was applied to each of the critical intersections along Union Street, assuming existing geometric designs and traffic controls. The results are included in the overall summary of Table 7-3. For unsignalized intersections, LOS results are calculated separately for each critical move. Values of "E" and "F" for left-turns from minor streets to major ones indicate the delays experienced by these vehicles waiting for gaps in heavy opposing traffic streams; e.g., left turns from Mill Street onto Union Street. In addition, right turns out of the side streets, and left turns into these streets, encounter delays because of high opposing volumes on Union Street.

With the basic growth assumptions outlined above, both Crawford Square and Union/Mill/Center Streets fail as unsignalized intersections. While no warrant analysis was performed at these locations, both seem certain to qualify for traffic signalization by the time these volumes are achieved, regardless of whether or not commuter rail service is provided to a station on Union Street.

7e. Station Traffic

A Holbrook-Randolph commuter rail station on Union Street would be located on the former station site, which also serves as a stop for the Cape Cod trains. To serve anticipated demand, it is planned to provide parking on both the west and east side of the tracks, accessible from Mill Street and Center Street, Holbrook. Even so, parking will represent a constraint on demand at this location.

One consequence of this is that AM vehicle arrivals will peak early, possibly before the general area peak hour (7:30-8:30). Another consequence is that a large drop-off clientele is expected to use this station. Therefore, traffic volumes include significant numbers of exiting vehicles in the morning, and entering vehicles in the evening, peak hours, compared with a station at which most arrivals represent parking vehicles.

Patronage forecasts for a Holbrook-Randolph station, by mode of access, were produced for 4 rail alternatives, as described in Section B (Methodology).

For purposes of the traffic analysis, forecasts for commuter rail Alternative 3a, Middleborough line only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 399 daily parkers, 460 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals, or 239 parking vehicles arriving AM, departing PM, and 276 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 7-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic, none are assumed to represent local traffic already using Union or other streets. In fact, however, it is more likely that some station traffic, particularly Holbrook and Randolph resident traffic, is traffic which would otherwise use local streets to access Route 28, Route 37, or an intermediate park-ride facility such as the Quincy-Adams or Braintree Red Line stations.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 7-4, represent Peak Hour increases above Base 2000 volumes of 6 to 16 percent along Union Street, depending on location. Level-of-Service results for each intersection under future volume conditions, assuming no roadway improvements, are shown in Table 7-3.

Added station traffic would add to congestion and delays along the Union Street corridor, particularly at the intersections of Union/ Mill/Center Streets, Holbrook Square, and Crawford Square. Crawford Square was also analyzed as a signalized intersection, since signalization here is inevitable with or without a railroad station. As shown in the Table, this improves operations at this location to Level-of-Service B-C with or without a station.

7f. Grade Crossings

All 4 grade crossings in this segment are in Holbrook: 2 close to the station site (Union Street and South Street), 2 in the southern part of town, close to the Avon and Brockton boundaries (East High and Spring Streets). The latter 2 are within about 525 feet of each other, and are located on 2 streets which merge about 600 feet east of the track.

With Old Colony commuter service through this built-up area, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. The schedule currently envisaged calls for half-hour commuter-train headways on the Middleborough Line during peak hours, with other activities (freight, Cape trains) restricted to off-peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line. At none of the crossings will it be necessary for the train to be stopped across the street.

The approximate distances from each grade crossing to the nearest intersections on both sides are:

	Distance (feet)
Union Street	
--track to Crawford Square	>4,200
--track to Franklin Street	>5,000
South Street	
--track to Centre Street	775
--track to Rockwood Street	1190
High Street	
--track to Spring Street	610
--track to Glendon Street(Avon)	390
Spring Street	
--track to Glendon St.(Avon)	490
--track to E. High St.	720

Traffic volume information is available only for Union Street. But Union Street is clearly the heaviest-traveled route in the area. Consequently, queue lengths were calculated assuming volumes and approach rates for Union Street; these were then applied to the other grade crossings to represent a "worst case" traffic condition, because Union Street queue lengths are not likely to be exceeded on the lesser streets. The results are illustrated in Table 7-4.

The conclusions of this analysis can be summarized as follows:

- Union Street--queues on this street will back up about 590 feet on average in the peak direction, and as far as 700-725 feet in the "worst case" maximum-arrival scenario. Westbound in the morning, this distance extends beyond Center Street, Holbrook, but not as far as Lakeview Avenue.

On the Randolph side (eastbound) in the evening, the queues will extend across the Mill/Center Street intersection, but do not reach any intersecting streets beyond this point.

- South Street--vehicle queues away from this crossing will not extend far enough to interfere with operations at any nearby intersection even under "worst-case" conditions.

- East High and Spring Streets--the potential exists for eastbound vehicle queues on either or both streets to extend beyond the 2 ends of Glendon Street in Avon under average conditions, if vehicle arrival rates are comparable to those on Union Street. The distance along East High Street between Glendon and the track is short enough that an eastbound queue of 18 vehicle lengths, corresponding to an average hourly arrival rate of 720 vehicles or a maximum (95th percentile) rate of 520 vehicles, will extend back as far as the intersection.

- Glendon Street is a short residential street providing local access to fewer than 20 residences. At worst, residents of the street will experience short delays exiting the street at both ends during "worst-case" train passbys. However, (a) it is very unlikely that peak-direction traffic volumes on East High or Spring Streets will in fact approach the levels at which such delays would occur, except in very rare instances; (b) the likely delay exiting Glendon Street itself will never be more than a few seconds; and (c) the number of vehicles delayed on Glendon Street is never likely to be more than 1 or 2 at maximum, so that the effect will be similar to that of any driveway close to a signalized intersection.

In the other direction (westbound), the 2 vehicle queues on East High and Spring Streets will not meet except under unusually heavy traffic conditions, so that no conflict problems are envisaged here.

7g. Mitigation Measures

The following traffic measures are proposed:

- Grade crossing controls--installation of full signalized gate controls at all grade crossings in this segment.

- Traffic signals at Mill/Center Streets--installation of interconnected traffic signals at the Union Street intersections with Mill/Center Streets (Randolph) and Center Street (Holbrook). Traffic signals will be equipped with railroad pre- emption sequencing.

- With signals, the 2 intersections should operate at satisfactory Levels of Service (C and D in AM and PM Peak Hours, respectively), compared with existing unsignalized operation. Vehicles on minor approaches will still be subject to delays, but turning movements will be able to be made in an orderly fashion.

- Street improvements--realignment of Mill/Center Street (Randolph) approaches to provide 2 approach lanes in each direction (left-turn and through-right- turn lanes on Mill, left-through and right-turn lanes on Center). Removal of existing island, channelization and curbing installation on southwest quadrant.

- Widening of Union Street to 3 lanes from west of Mill/Center to east of Center Street (Holbrook); striping of exclusive left-turn lanes on both Union St. approaches at Mill/Center Streets (Randolph).

- Conversion of the crescent-shaped segment of Center Street north of Union St. to one-way northbound (i.e., inbound from Union Street) operation.

A plan for the recommended street improvements are included in Chapter IX of the DEIS, Figure IX-C3.

TABLE 7-1

Accident Incidence from Police Records:
Randolph and Holbrook*

	Numbers of Recorded Accidents 1985	1986	1987**	Est. Rate per million vehicles
Randolph				
Union/North/N. & S. Main St.	89	72	30	8.7
Union/Mill/Centre St.	21	12	5	2.5
Holbrook				
Union/Center St.	n/a	19	7	--
Union/Plymouth/Franklin St. (gen. Holbrook Square area)	n/a	46	20	--

* within a block radius
** through June

n/a = not available
-- = no accident rate calculated

TABLE 7-2

Accident Classification
(January-June 1987)

Type of Accident	Number
Angle collision	19
Rear-end collision	2
Hit fixed object	3
Hit pedestrian	1
Hit motorcycle	1
Hit/run (1 head-on)	2
Other/unidentified	2
Total	30

TABLE 7-3

Level of Service Analysis
Holbrook-Randolph Station Area Intersections

				Level of Service: Year 2000 Traffic			
		Existing Traffic		without Commuter Rail Station		with Commuter Rail Station (w/o mitigation)	
Intersection	Signalized?	AM	PM	AM	PM	AM	PM
Union/North Main No.St. (Crawford Sq., Randolph)	No	E/F*	E/F*	F*	F*	F*	F*
	YES**	--	--	B	C	B	C
Union/Mill/ Center St.	NO	E*	F*	F*	F*	F*	F*
	YES	--	--	C	C	C	C
Union/Franklin St. (Holbrook Sq.)	YES	C	D	C	D	C	D

*for critical through moves/left turns at unsignalized intersections; this is not unusual or necessarily unacceptable, unless side-street vehicle demand is so high that long queues form and long delays induce drivers to accept unsafe gaps.

**analyzed assuming a 2-phase traffic signal is installed in the near future.

TABLE 7-4

Queuing Analysis: Union Street Grade Crossing

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Union St. WB					
AM Peak Hour	1093	27	33	725	72
PM Peak Hour	817	21	26	575	66
2. Union St. EB					
AM Peak Hour	567	14	19	420	59
PM Peak Hour	1041	26	32	700	71

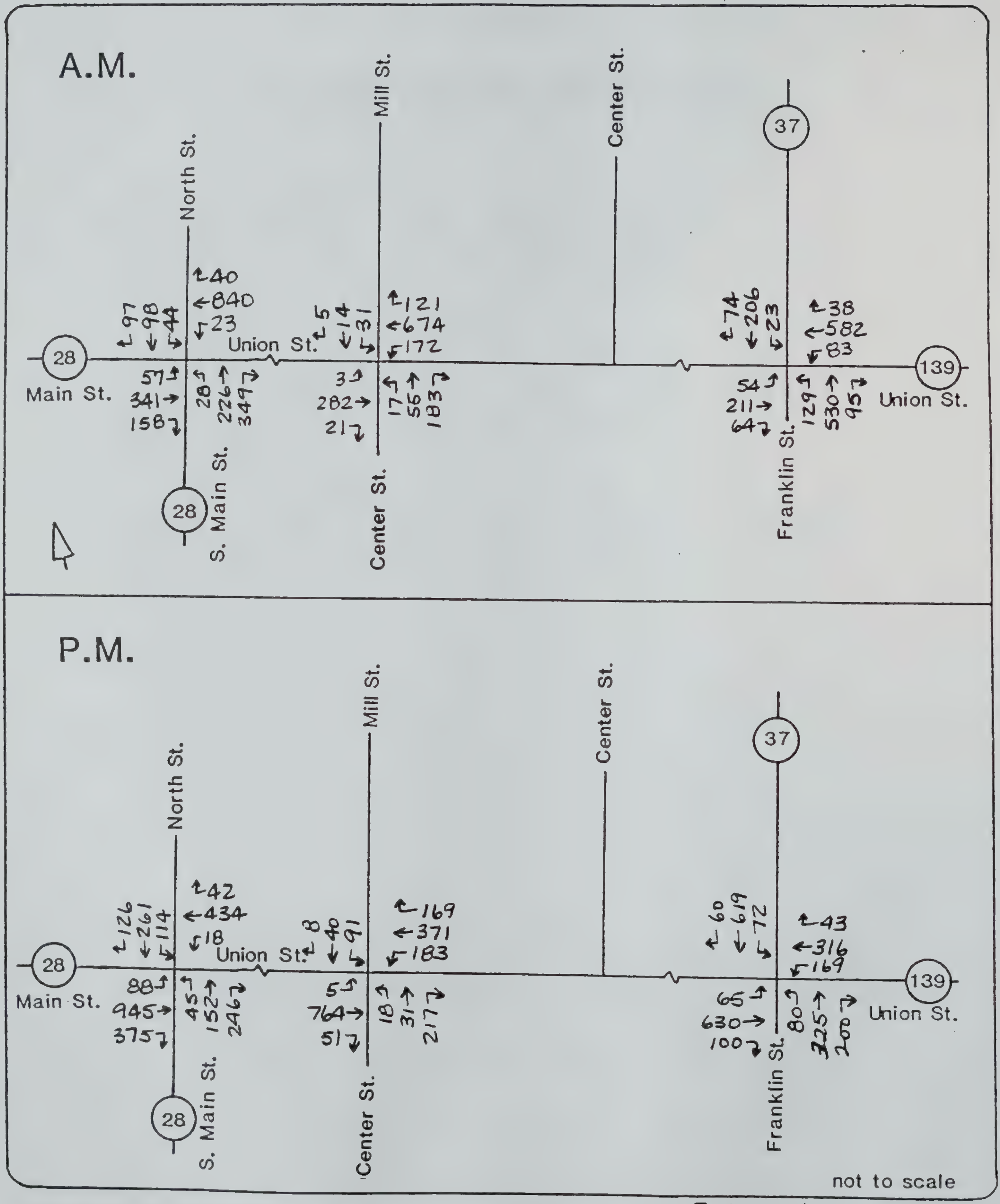

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FIG. 7-1
MIDDLEBOROUGH:
Holbrook-Randolph
EXISTING TRAFFIC

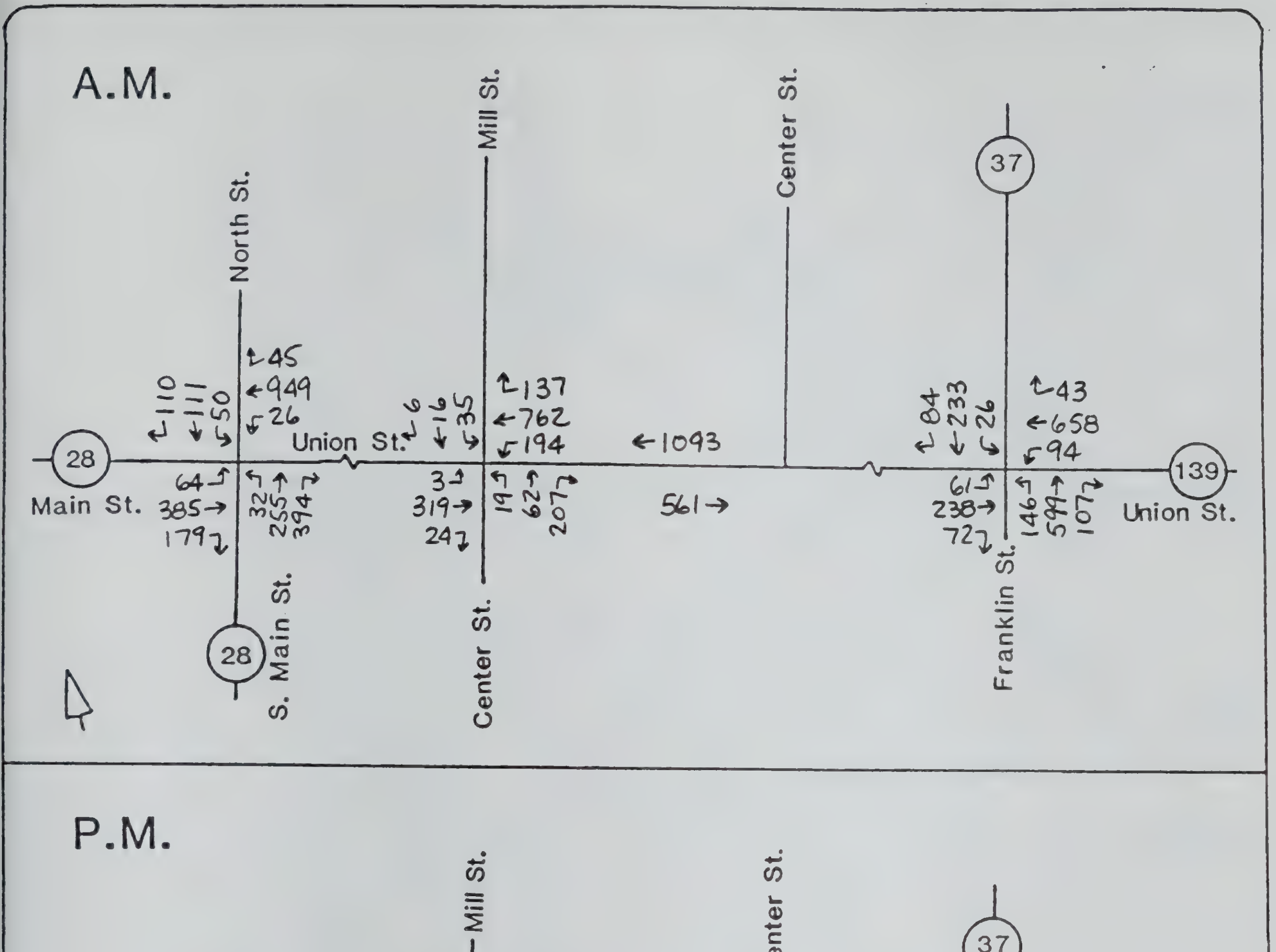

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FIG 7-2
MIDDLEBOROUGH:
Holbrook-Randolph
YEAR 2000 BASE

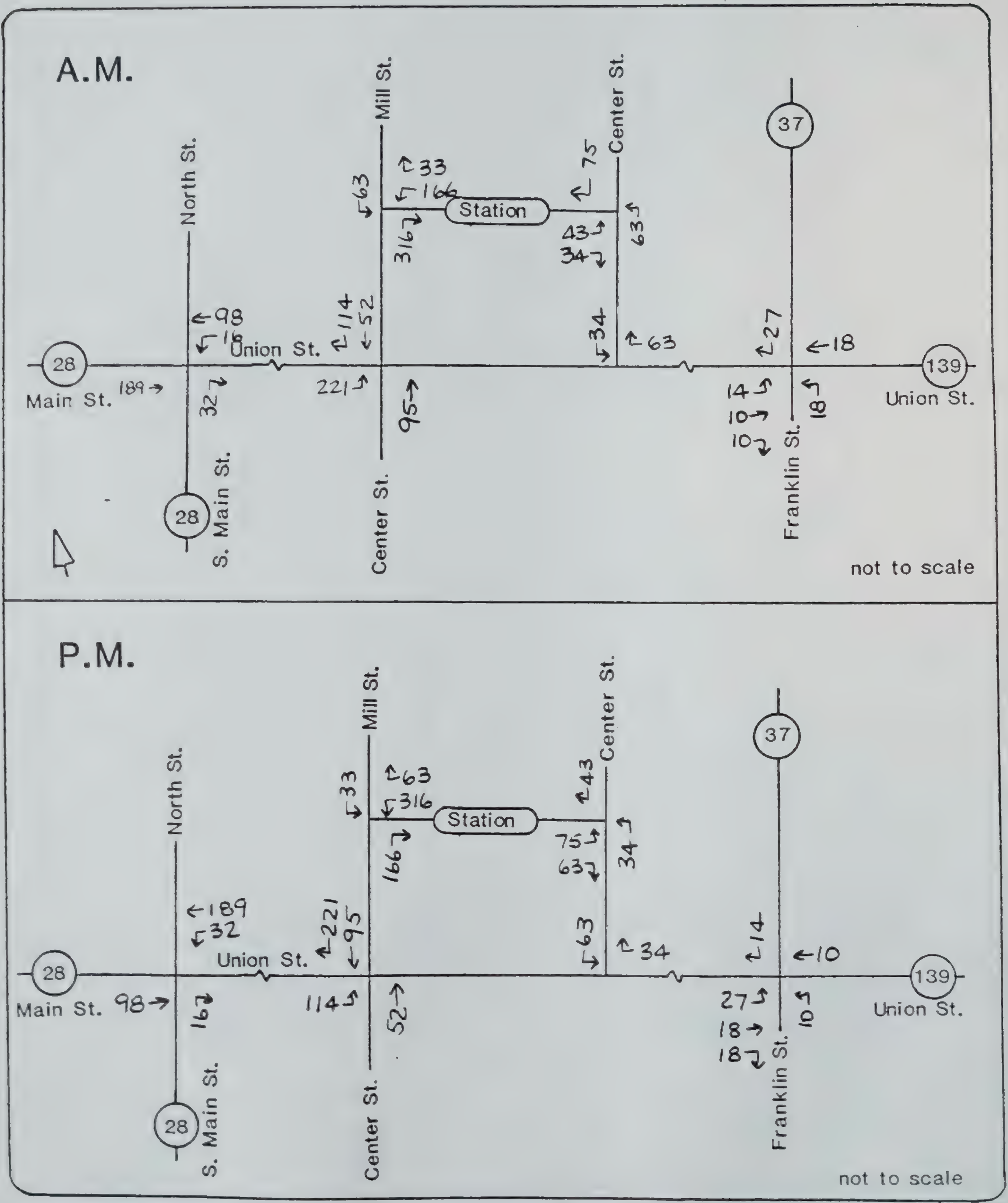

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FIG 7-3
MIDDLEBOROUGH:
Holbrook- Randolph
STATION TRAFFIC

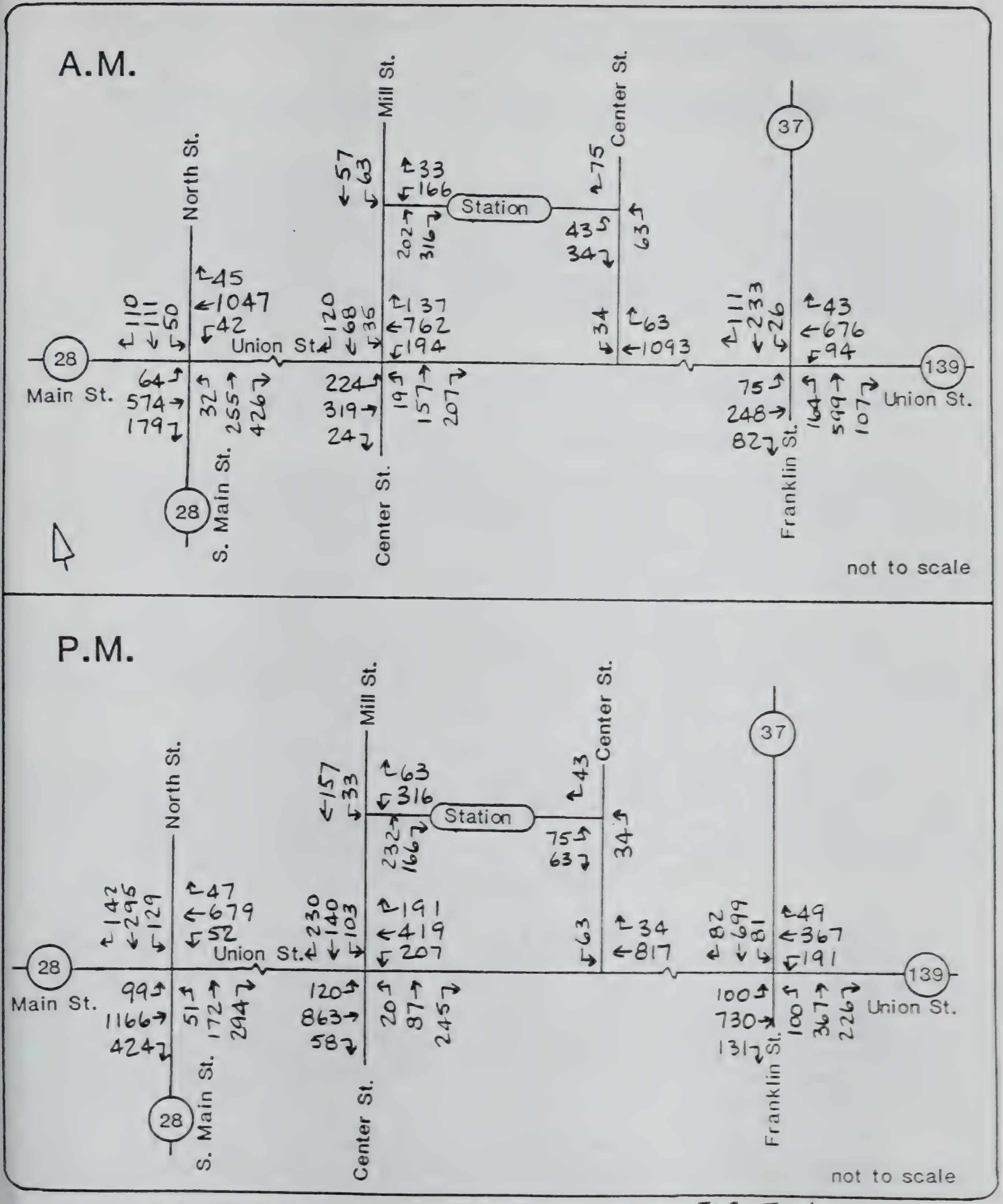

FIG 7-4
MIDDLEBOROUGH:
Holbrook-Randolph
FUTURE, WITH STATION

8. Montello and Brockton Stations and Line Segment from the Avon-Brockton Line to Grove Street, Brockton

This segment extends from the Avon-Brockton Town Line to Grove Street, in Brockton, on the Middleborough Line. There are no grade crossings in this segment.

There are two potential station sites, either or both of which might be activated. One is in north Brockton, close to the intersection of Routes 37 and 28 (Howard Street and North Montello Street) and the other, a downtown station adjacent to the existing public parking lot on Montello Street south of Crescent. The two stations are located approximately 2 miles apart. The primary street traffic impacts resulting from the Old Colony project relate to these station locations.

8a. Montello Station

1) Existing Streets and Intersections

North Montello Street in this area, designated Route 28, is a narrow, 2-way urban street, with sidewalks on both sides and frequent intersections. The street is lined with closely- spaced single- and multi-family dwellings, mixed with some business and industrial uses. Close to the Montello station site are several fast-food restaurants and grocery stores, as well as auto repair shops and similar uses.

Spark Street, a short street parallel to Montello St. but located on the east side of the tracks, is a minor street serving the nearby residential neighborhoods and the industrial uses located close to the railroad tracks. It is wider than Montello Street at this location (approximately 35 feet), also with sidewalks on both sides.

The railroad track forms a barrier to cross traffic, which can only use the Howard, Field, and Ames Street bridges in this area to travel from one side of Brockton to the other. Howard and Field Streets flank the proposed station location on the north and south sides respectively. Both bridges are narrow 2-lane structures, with moderate approach grades to allow them to clear the track.

West of the track, Howard Street meets the 5-way signalized intersection of Montello/Howard/Albion Streets, with a separate right-turn channel for vehicles heading northward on Route 28. East of the track, the intersection of Howard and Spark Streets is substandard, with a memorial island awkwardly placed for left-turning eastbound traffic, and stop-signs in unexpected locations (i.e., governing the through moves). A posted sign prohibits left turns from Spark Street NB to Howard; but the sign is disregarded by local traffic, which makes this move in large numbers.

The Field Street bridge and approaches are noteworthy because of the bridge's narrow width and the sharp approach curves to the east, both causing limited sight distances. The Field/Montello Street intersection is stop-sign controlled, as is the Field/Spark Street intersection.

2) Existing Traffic Volumes

Traffic counts were performed at the 4 intersections defining the boundaries of the station area:

- Montello/Howard/Albion St.
- Howard/Spark St.
- Field/Spark St.
- Montello/Field/Livingstone St.

The count data was assembled, annualized and balanced to produce Existing Traffic Volumes, as illustrated on Figure 8- 1. The following was noted from the counts and field observations:

a. The Howard Street bridge carries high volumes in the peak directions, with the majority of its traffic oriented north and east of the bridge.

b. There is heavy demand for the illegal left-turn from Spark St. NB to Howard Street in both peak periods. Left- turners here conflict with the heavy bridge-bound movements from Winter and Howard Streets north of the bridge, with 3 lanes of entering traffic merging to 1 lane over the bridge itself.

c. The Montello/Howard Street intersection appears to operate fairly well at present, although it handles large volumes of traffic. Few difficulties were observed at either end of Field Street, although left-turning vehicles from Field onto Montello SB can experience moderately long delays waiting for gaps in traffic. It is unlikely that either Field Street location warrants signalization under present conditions, however.

d. Montello Street traffic south of Howard is not strongly directional, but includes Brockton-bound as well as northbound traffic in the AM Peak Hour. Other streets, including Howard Street, show a stronger directionality, with north- and east-bound traffic predominating in the morning, and the reverse movements governing the evening peak.

3) Traffic Accident Experience

Investigation was made of traffic accident incidence in the vicinity of the 2 station sites. The Brockton Police department did not permit direct access to traffic accident records; however, the Department did provide information on numbers of "incidents", including reported motor vehicle incidents, from which rough estimates of the numbers of accidents at various location could be made. These totals are summarized in Table 8-1; but no firm conclusions can be drawn from such a tabulation in the absence of more detailed information on the types of accidents and rates of incidence.

4) Future Growth Assumptions

For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 0.6 percent per year, were computed and are presented in Figure 8-2. Level of Service Analysis of area intersections given these future base volumes yielded the results shown in the overall summary of Table 8-2 below.

For unsignalized intersections, LOS results are calculated separately for each critical move. Values of "E" and "F" for left-turns from minor streets to major ones indicate the delays experienced by these vehicles waiting for gaps in heavy opposing traffic streams; e.g., left turns from Field Street onto Montello Street.

At Montello/Howard Streets, the existing intersection will be close to capacity given these future volume assumptions, with AM Peak Hour operations somewhat more congested than PM Peak Hour conditions.

The Howard/Spark Street case is special, because of the unorthodox design and stop-sign placement. It was analyzed as a 3-way intersection, but with the Howard Street left-turn movement assumed to be the through move, and the Spark Street NB movement treated as a right-turn move from a minor street. The results above reflect these assumptions; but should be recognized only as approximations of Levels of Service.

5) Station Traffic--Montello

Patronage forecasts for a Montello station, by mode of access, were produced for 4 rail alternatives, as described in Section 2 (Methodology). For purposes of the traffic analysis, forecasts for the commuter rail Alternative 3a, Middleborough Line only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 400 daily parkers, 122 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 240 parking vehicles arriving AM, departing PM, and 73 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin and population concentrations within Brockton, are as shown on Figure 8-3.

It was assumed that parkers would be oriented primarily toward a Spark Street driveway, while drop-off vehicles would use either the Spark Street or Montello Street entrance, depending on ease of access.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Montello, Howard, or other streets. In fact, however, it is more likely that some station traffic, particularly Brockton resident traffic originating nearby, is traffic which would otherwise use these streets to make commuting trips.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 8-4, represent increases above Base 2000 volumes of 2-8 percent on Montello Street, and up to 32 percent on Spark Street close to the station entrance. Level-of- Service results for each intersection under future volume conditions are shown in Table 8-2.

The addition of station traffic will degrade performance somewhat at all nearby intersections, increasing delays at the Montello/Howard Street signal during both Peak Hours. PM Peak Hour operations at this location will fall to LOS "E", while AM Peak Hour operations will remain at "E".

At unsignalized intersections, the principal noticeable effect of adding the station will be to increase delays for vehicles attempting to make left turns from minor streets. Such delays will be acceptable, provided that left-turn demand is not high enough to cause long queues to develop on these side streets.

The preferred access route to a station at this location will be via Montello, Spark and Howard Streets, with traffic to be discouraged from using Field Street as far as possible. In order to accomplish this, it is assumed that the Howard/Spark Street intersection will need to be substantially rebuilt to replace the existing inadequate design.

6) Mitigation Measures

The following traffic measures are recommended:

- Review existing signal installation at Howard/N. Montello; retime if necessary.

- Reconstruct intersection of Howard/Sparks Street as a "T" intersection, with Howard Street as through street. Several alternative designs were examined. Sketches of two alternative means for making improvements at Howard/Spark Street are included in DEIS Chapter IX, Figures IX-C4a and IX-C4b.

8b. Brockton Station

1) Existing Streets and Intersections

The downtown Brockton station site is located on Montello Street between Crescent and White Streets, close to the Brockton Area Transit (BAT) terminal on Main Street. The general area is more commercial in character than is the area near the Montello station site, and the streets tend to be a closely- spaced grid. The site is occupied by a City-owned 86-space parking lot, most of which is permit parking, but with a small number of metered spaces.

No additional parking would be provided in conjunction with the Brockton station. It is assumed that public paid parking may be provided close to the site by others; or, in the absence of this, a Brockton train station at this location would be primarily used by walk-in, drop-off, or bus access patrons.

Montello Street at this location is roughly 28 feet curb-to-curb, with sidewalks on both sides. The street has been newly-repaved within the past several years. No on-street parking is permitted on Montello Street in this area, so that the full street width is available for traffic.

The intersection of Montello and Crescent Street is signalized. The Montello Street approaches are single-lane, but there is sufficient room on Montello NB to allow through traffic to bypass left turns. Crescent Street east of Montello is one- way eastbound, and provides the closest crossing under the elevated railroad structure for station patrons from East Brockton and other points east. Crescent Street in this section is designated Route 28, and its EB approach to Montello is 2 lanes wide.

2) Existing Traffic Volumes

A traffic count was performed at the Montello/Crescent Street intersection to determine existing patterns in the area. The resulting annualized volumes are presented in Figure 8-5.

No major traffic problems were observed at this location. Normal signal delays were experienced by traffic on the 3 active approaches. However, the maximum cycle length at this fully-actuated signal (exclusive of a pedestrian phase call) is 76 seconds, so that maximum delays tend to be short.

3) Accident Experience

As in the Montello Station case, Brockton accident records only permitted a tabulation of accident incidence at nearby intersections. The accidents included in this compilation were those reported at intersections only. Accidents for which the only identification was a single street name (e.g., "Main Street", "Plain Street") were not included, even though some may, in fact, have been close to intersections. At the Montello/Crescent intersection, one accident was reported in 1986 and four in 1987, while at the Montello/White intersection, one in 1986 and one in 1987.

Again, it is difficult to draw conclusions from the limited accident data available; but no location stands out as an obvious safety problem.

4) Future Growth Assumptions

As at Montello, Year 2000 Base Traffic Volumes at the downtown Brockton station location were estimated based on an area growth factor of 0.6 percent per year. The resulting volumes are presented in Figure 8-6.

Given these growth levels, future AM and PM Peak Hour Levels of Service at the Crescent/Montello St. intersection will be C and D respectively.

Patronage forecasts for a Brockton station, by mode of access, were produced for 4 rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for the commuter rail Alternative 3a, Middleborough Line only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 272 daily drop-offs, with a large component of walk-in traffic (919 boarders) as the predominant source of patronage. No parking component was assumed.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 163 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 8-7.

As at Montello, station volumes were assumed to be net additions to existing traffic, rather than diverted existing traffic.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 8-8, represent increases above Base 2000 volumes of 8 to 64 percent, depending on location. Level-of-Service results at the Crescent/Montello Street intersection under these conditions remain C and D respectively for AM and PM Peak Hour.

5) Mitigation Measures

The following traffic measures are recommended at Brockton:

- Traffic signal--review existing signal installation; adjust phasing and timing if necessary.
- Street improvements--provide 2 full approach lanes on Montello St. NB approach to Crescent Street, through lane-marking and minor widening if necessary. It is proposed that bus loading and unloading will occur at curbside.

Improvements proposed for the Montello Street-Crescent Street intersection are shown in DEIS Chapter IX, Figure IX-C5.

TABLE 8-1

Accident Incidence from Brockton Police Records --Montello Station Site

Intersection	Number of Recorded Accidents 1985	1986	1987
Howard/Montello	1	11	2
Howard/Spark	--	2	2
Howard/Winter	2	--	--
Field/Montello	--	1	2
Field/Spark	5	11	7

TABLE 8-2

Level of Service Analysis
Montello Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service: Year 2000 Traffic without Montello Station AM	PM	Level of Service: Year 2000 Traffic with Montello Station AM	PM
Howard/Montello	YES	E	D	E	E
Howard/Spark	NO				
--left turn from Spark		E	E	E	F
Howard/Winter	NO				
--left turn from Winter		--	F	--	F
Field/Montello	NO				
--through moves/left turns from Field		C/D	D/E	C/D	E/F
Field/Spark	NO				
--through moves/left turns from Field		B	C	B/D	C
Montello/Driveway*	NO	--	--	C	D
Spark/Driveway*	NO	--	--	C	C

*for critical through moves/left turns; other moves are all A-B.

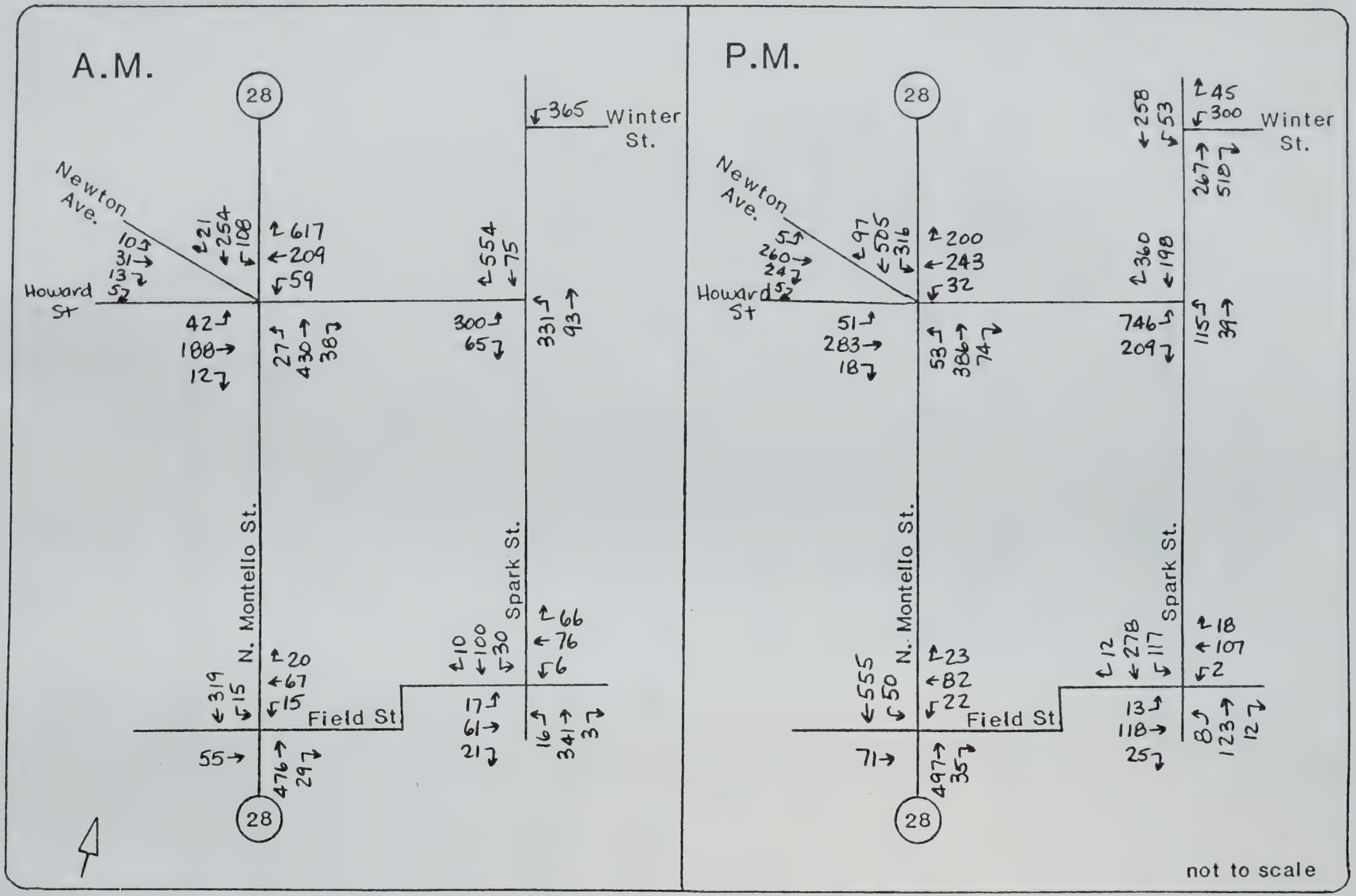

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FIG 8-1
MIDDLEBOROUGH: Montello
Existing Traffic

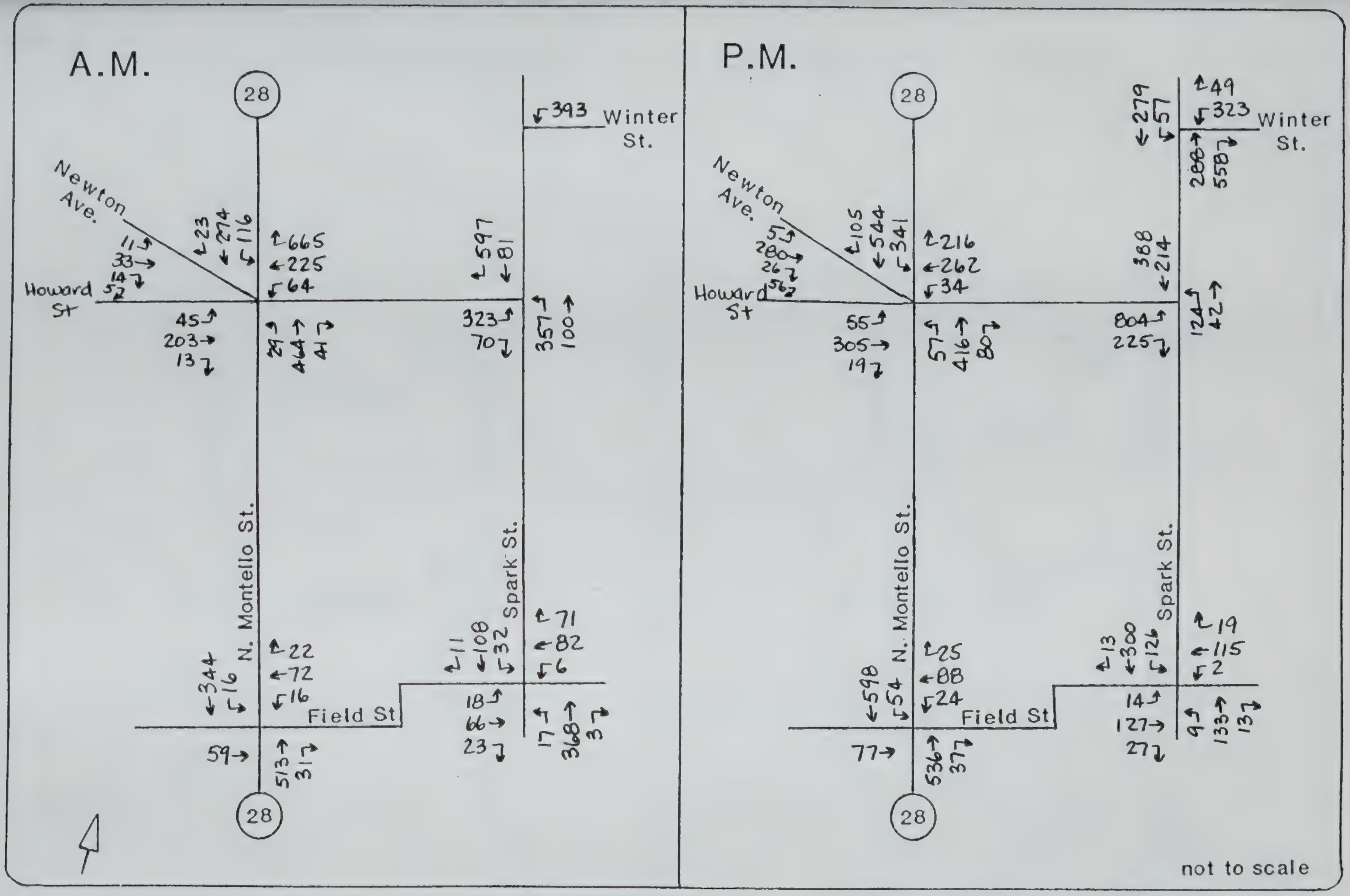

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FIG 8-2
MIDDLEBOROUGH: Montello
Year 2000 Base Traffic

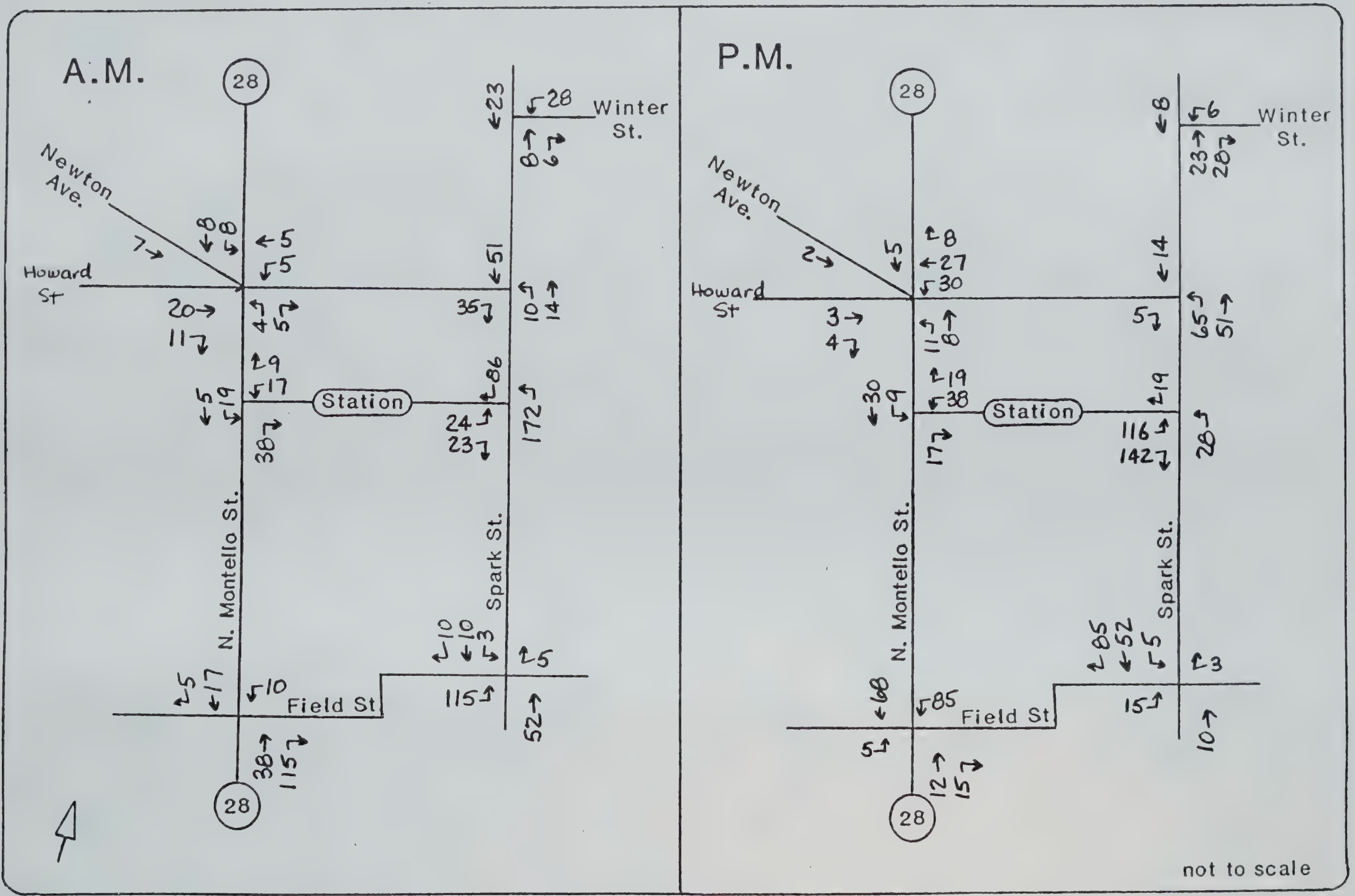

FIG 8-3
MIDDLEBOROUGH: Montello
Station Traffic

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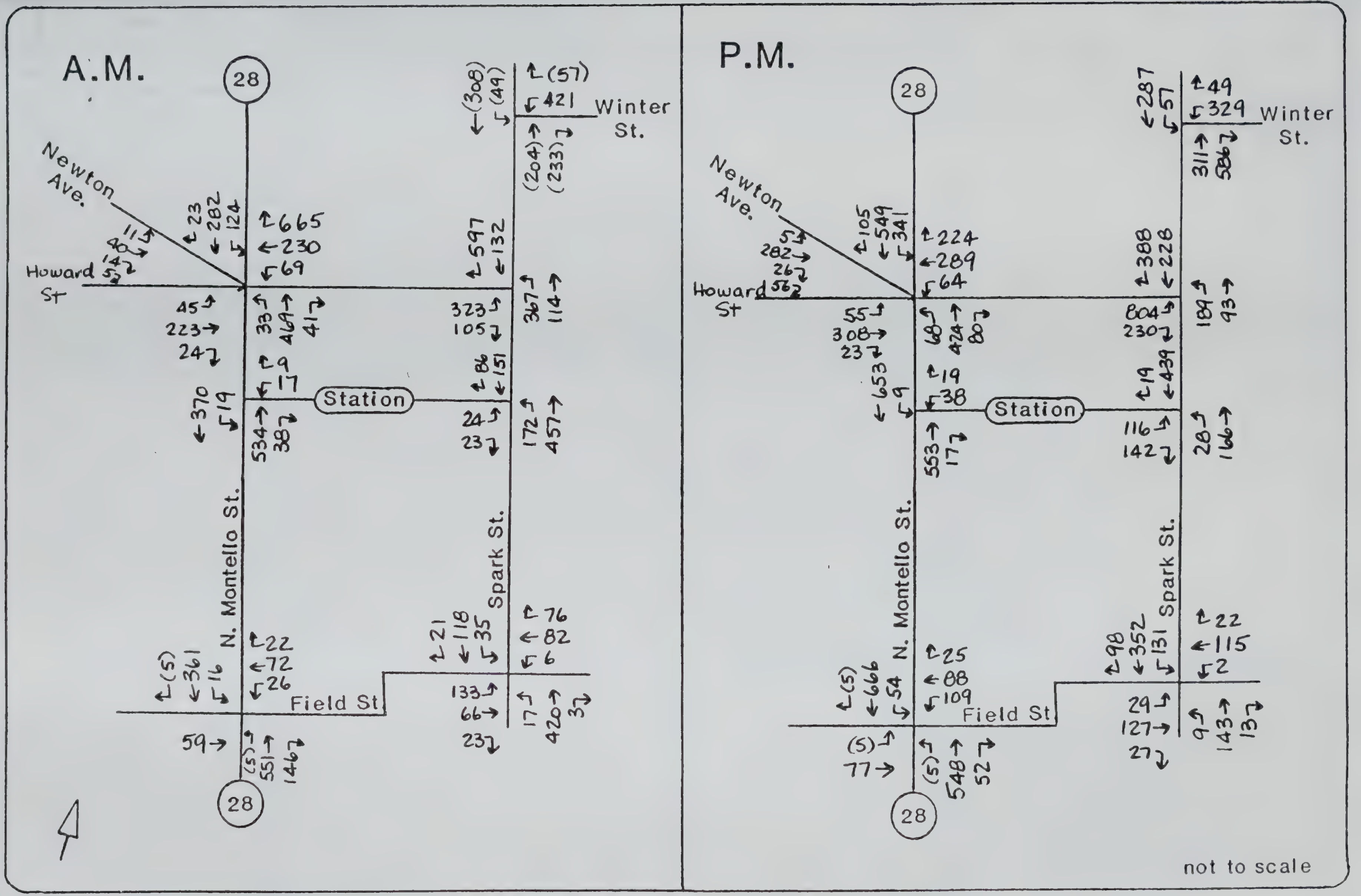

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FIG 8-4
MIDDLEBOROUGH: Montello
Future Traffic, with Station

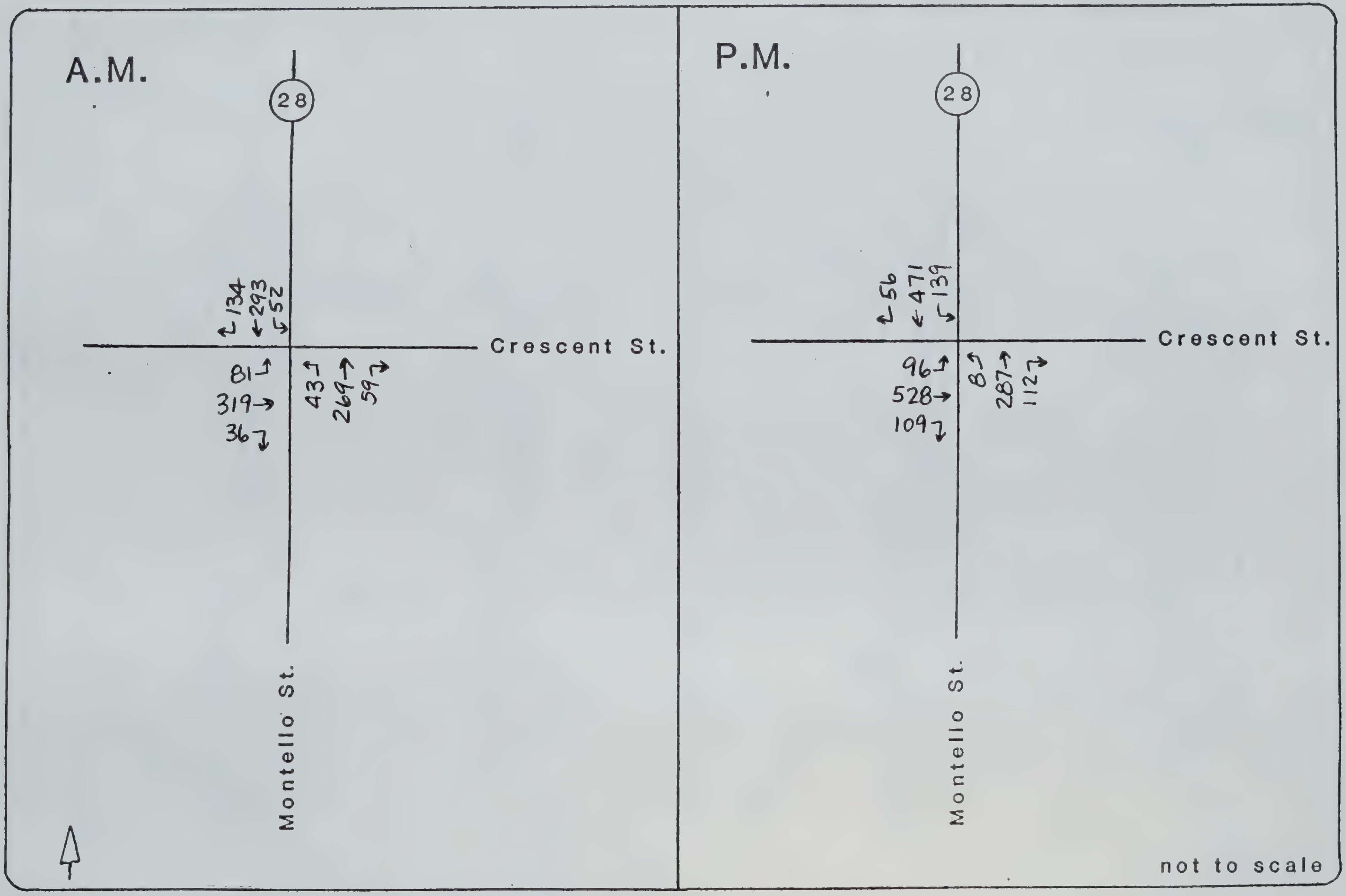

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FIG 8-5
MIDDLEBOROUGH: Brockton
Existing Traffic

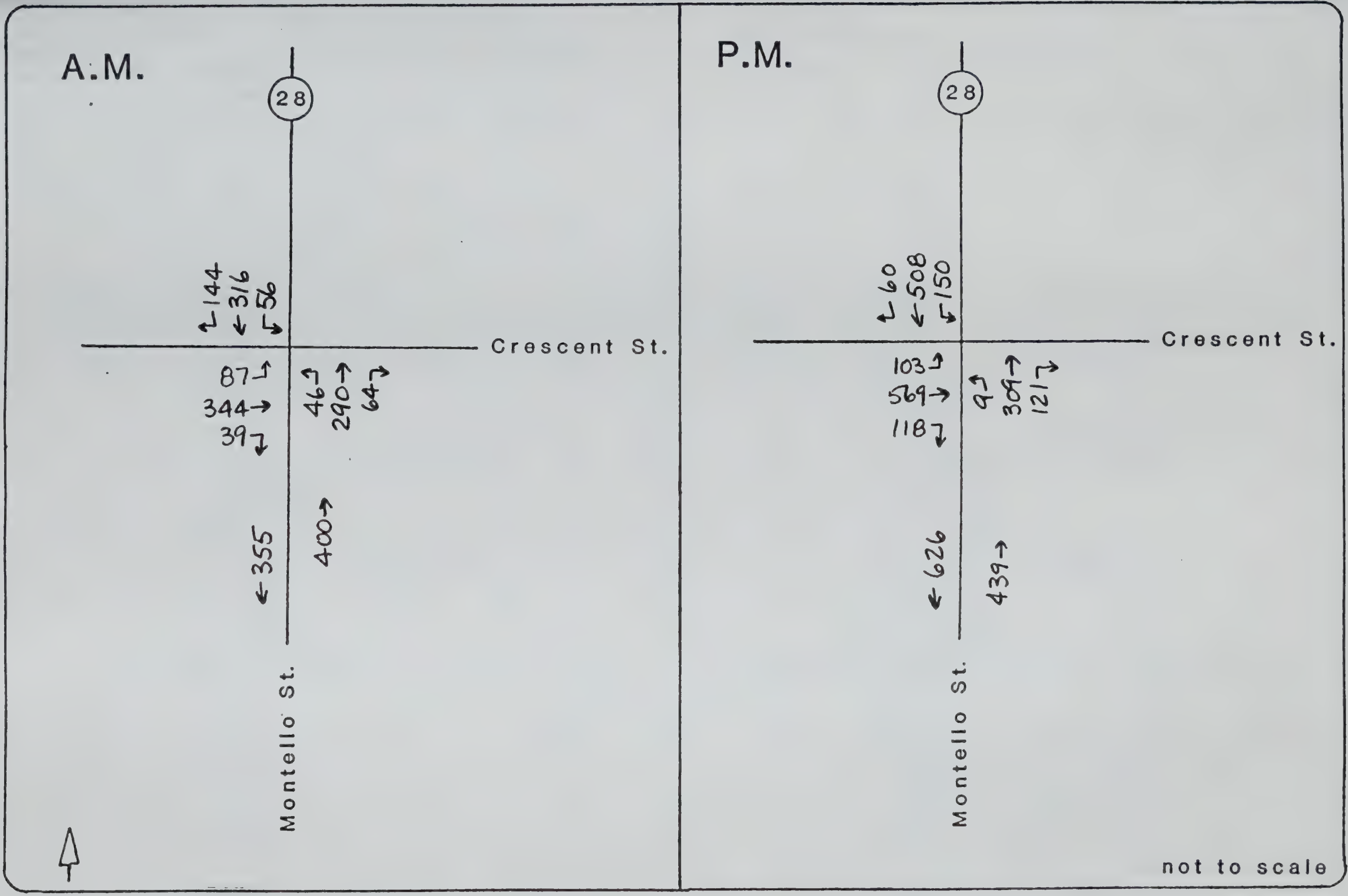

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FIG 8-6
MIDDLEBOROUGH: Brockton
YEAR 2000 BASE TRAFFIC

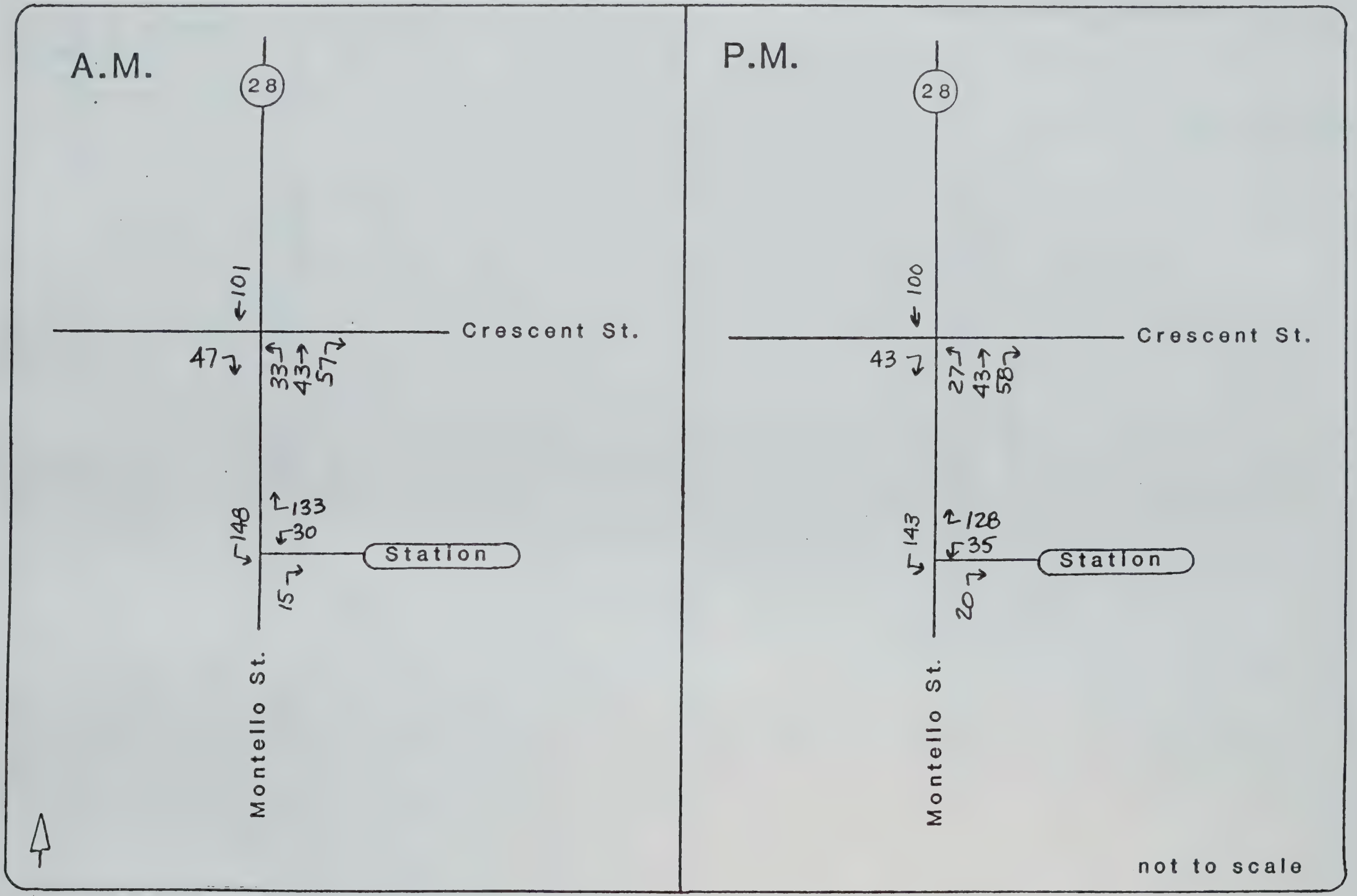

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FIG. 8-7
MIDDLEBOROUGH: Brockton
Station Traffic

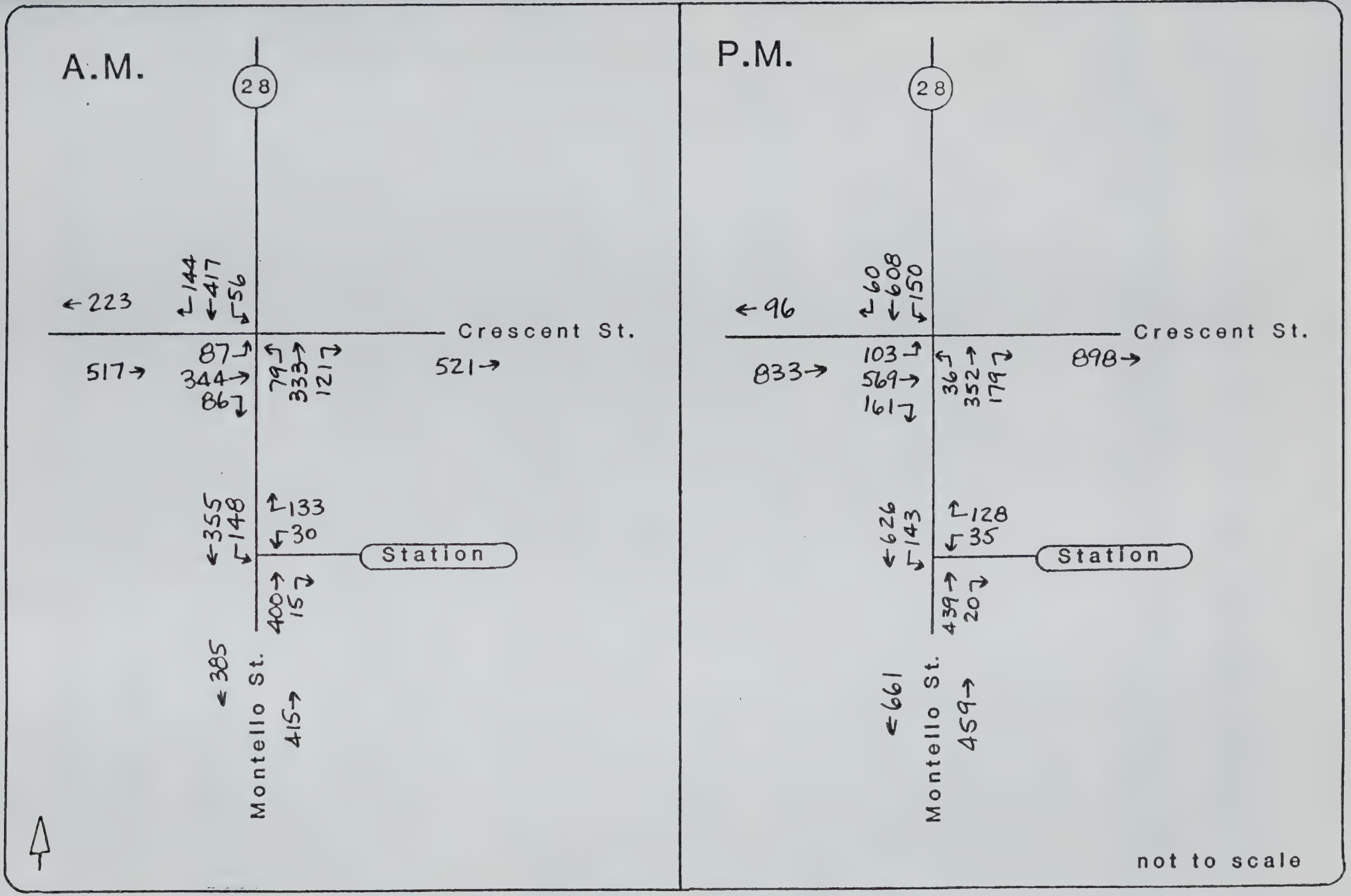

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FIG. 8-8
MIDDLEBOROUGH: Brocton
FUTURE TRAFFIC WITH STATION

9. Campello Station and Line Segment from Grove Street, Brockton to Brockton-West Bridgewater Line

This segment is from Grove Street to the West Bridgewater Line in Brockton, on the Middleborough Branch. The primary street traffic impact within this section would occur in the vicinity of the proposed Campello Station, located on Montello Street close to Plain Street. There are no grade crossings in this segment.

9a. Streets and Intersections

The proposed station location is just north of the existing Plain Street Bridge railroad bridge, and is bounded by Plain Street and Montello Street. Montello Street (Route 28) in this area is an urban street, of narrow width (approximately 25 feet curb-to-curb), with frequent intersecting streets and sidewalks on both sides. It travels as one lane in each direction, and on- street parking is permitted in most locations. Close to the station site, the street is a mixture of residential and low-level commercial uses (e.g., auto repair shops, building materials suppliers, etc.).

Montello Street ends at Plain Street, and the Route 28 designation shifts to Main Street (1 block west) at this point. Main Street is the principal street providing access to downtown Brockton from points south, but it becomes one-way northbound several blocks north of Garfield Street.

Plain Street has traditionally provided access to downtown Brockton from points south and east of the railroad track. Within recent years, the Plain Street railroad bridge has been closed to traffic, with a detour in place using Meadow Lane and Meadowbrook Road. A multi-phase construction project, including sewer work and reconstruction of the bridge, is currently in progress. As part of this project, Plain Street is being realigned east of Meadowbrook Road in order to replace the sharp roadway curve, originally built to provide a right-angle crossing of the railroad, with a smoother curve. Plain Street south of Meadow Lane is a suburban-type roadway serving low-density residential neighborhoods.

North of the railroad bridge, Plain Street terminates at Main Street approximately 220 feet west of the Plain/Montello Street intersection. Plain/Montello Street is not signallized. The 4-way intersection of Plain/Main/Keith Avenue is governed by a pre-timed traffic signal with a 60-second cycle, exclusive of the pedestrian phase. Keith Avenue is one-way WB i.e., away from the intersection.

Garfield Street is a short (1-block) street, one-way WB, connecting Montello and Main Streets north of Plain Street. Five residential properties abut the street on the northern side. Main, Plain, Montello and Garfield Streets enclose a small town- owned park area.

9b. Existing Traffic

Because of the discontinuity of Montello Street and the one-way operation on Main Street north of this area, heavy turning movements occur from

Main Street NB to Montello NB and the reverse, using the short stretch of Plain Street between Main and Montello (or Garfield Street, in the SB direction) as a connector.

These movements were documented by traffic counts at several area intersections, conducted in 1986 and 1987 for this project. The count data from both years was standardized and converted to annualized volumes, displayed on Figure 9-1 as "Existing Traffic".

The most noteworthy characteristics of these volumes include:

- Light-to-moderate through volumes on major streets.
- Heavy right turns from Main Street NB to Plain Street EB, with heavy left turns from Plain Street EB to Montello NB in both AM and PM Peak Hours; corresponding heavy turning moves in the SB direction from Montello to Plain to Main Streets, again in both peak hours.

Traffic on Plain Street WB regularly backs up from the traffic signal as far as Montello Street and beyond. Meanwhile, NB traffic trying to turn left from Plain Street onto Montello is blocked by these queues and general opposing traffic flows, and itself backs up to Main Street.

Some SB Montello Street traffic turns onto Garfield Street to bypass the queues on Montello and Plain Streets, turning left at Main Street. This works adequately as long as the SB queue on Main Street at the signal is six cars or less; beyond that length, left turns from Garfield are blocked also.

Other than the Plain Street Bridge reconstruction, there are no traffic improvements imminent in the station area. Several uncommitted projects are included in the Transportation Improvement Program document, however, including a channelization project at Plain/Main and Montello Streets, and rehabilitation of the Perkins Avenue railroad bridge north of the station site.

9c. Accident Experience

As with other Brockton station sites, City Police data on the incidence of traffic accidents in the vicinity of the proposed Campello station were requested. Data received from the Police allowed a general tabulation of accidents occurring on particular streets, but generally did not identify locations at the intersection level, and provided no information on types of particular accidents. The accident incidence data has been compiled as shown in Table 9-1.

None of these totals are unusually high (the City-wide recorded accident total for 1986 is 4,087); so that no especially hazardous locations can be identified close to the station site on the basis of recent reported accidents. However, the form in which the data is recorded makes it difficult to draw any firm conclusions about accident incidence, causes, and potential remedies.

9d. Future Growth Assumptions

1) Pending Development Projects

None were identified near the station site.

2) Base Traffic Growth

Assumed Year 2000 base traffic volumes, based on an area growth factor of 0.6 percent per year, were computed and are presented in Figure 9-2. Future Levels of Service at nearby intersections were calculated, and are presented in Table 9-2.

On Plain Street WB approaching Main Street, the average AM queue building up on the red interval of a 60-second cycle is about 5 vehicles, or over 100 feet; in the PM Peak Hour, the corresponding average queue length on this approach is almost 7 vehicles, or about 150 feet. Queues which are longer than average occur occasionally, extending for almost the entire 220 feet to Montello Street.

9e. Station Traffic

Patronage forecasts by mode of access were produced for 4 rail alternatives, as described in Section B (Methodology). For purposes of analyzing traffic impacts of a Campello station, forecasts for commuter rail Alternative 3a, Middleborough Line only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 503 daily parkers, 153 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals or 302 parking vehicles arriving AM, departing PM, and 92 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figures 9-3a and 9-3b, assuming 2 access points at Terminal Place and either Riverside Avenue on Plain Street, or Plain Street itself opposite Meadowbrook Road.

Because it is desirable to encourage as much traffic as possible to avoid the Plain/Montello Street intersection, the assumption that right turns only would be permitted out of Terminal Place was made in the Figure 9-3a distribution. An alternative distribution, under which left turns and left-right- turn moves onto Garfield Street would be permitted, was also analyzed. This is shown in Figure 9-3b.

All station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Main, Plain, Montello or other streets.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figures 9-4a and 9-4b for the 2 circulation schemes, represent increases above Base 2000 volumes of 5 to 30 percent, depending on location. Level-of-Service results for each intersection under future volume conditions are shown in Table 9-2.

The primary advantage of "Scheme 1" is that it minimizes additional turning traffic at Plain/Montello: all traffic destined for Main Street exits onto Plain Street at a point east of Montello. This means that approach queues at the Main/Plain Street intersection will be increased somewhat; but this situation is preferable to adding left-turn traffic from Montello onto Plain Street.

The advantages of "Scheme 2" are that it provides more direct access to Main Street SB, particularly via Garfield Street, for traffic exiting the station, and removes such traffic from the left turn queue at Plain Street/Main Street. Its primary disadvantage is that it adds traffic to the Plain/ Montello Street intersection. Use of this alternative would require installation of traffic signals at Plain/Montello, and widening of Plain Street to allow provision of an exclusive left- turn lane, a step which would encroach upon the residential properties on the south side of Plain St.

With station traffic added under "Scheme 1", average queue lengths on Plain Street approaching Main increase to 5+ and 7 vehicles respectively in AM and PM Peak Hours. LOS results are still quite acceptable. Left-turn capability at Montello/Plain Streets declines somewhat as a result of added through traffic on Plain Street, but not significantly.

A third circulation scheme was also analyzed, involving creation of a one-way scheme around 3 sides of Keith Park. This would result in a revised traffic pattern, as shown in Figure 9-5. This pattern would provide the advantage of reducing vehicle conflicts at the Plain/Montello Street intersection, by removing westbound vehicles from the short section of Plain Street between Main and Montello, and rerouting these vehicles to Main via Montello and Garfield Streets. However, Garfield Street would then be required to carry much higher volumes than it does at present, most of this volume turning left onto Main Street. Left turns from Garfield Street could not be adequately handled without signal control at this location.

Left turn into the station from Montello Street SB should have storage room, in order to allow through traffic to bypass station traffic. Montello Street at the Terminal Place entrance is constrained by sidewalks and residences on both sides of the street, and it would be difficult to provide sufficient pavement width here for a formal southbound left-turn lane. It may be preferable from a traffic-flow perspective to relocate this station entrance to Riverside Avenue at Montello Street, directly opposite Keith Park.

Riverside Avenue is also the preferred entrance on Plain Street.

9f. Mitigation Measures

The following measures are recommended at this location:

- Station Entrance Location--provision of station entrances at Riverside Avenue on both Plain and Montello Streets. Designation of exit onto Montello Street as "right-turn-only" operation.

- Street Improvements--posting of "No Parking" signs on Montello Street close to Riverside Avenue.

- Plain Street Entrance--if this requires new driveway opposite Meadowbrook Lane, performance of sight distance observations; possible installation of traffic signals (this can only be determined after Plain Street Bridge reconstruction is completed).

Sketches of proposed intersection improvements are shown in DEIS Chapter IX, Figures IX-C6 and IX-C7.

TABLE 9-1

Accident Incidence from Brockton Police Records

Intersection	Number of Recorded Accidents	
	1986	1987
Main/Plain St.	--	--
Montello/Plain St.	2	3
Montello/Perkins St.	4	6
Montello/Terminal Place	1	--
Keith/Garfield St. (sic)	--	1
Keith/Main St.	1	--

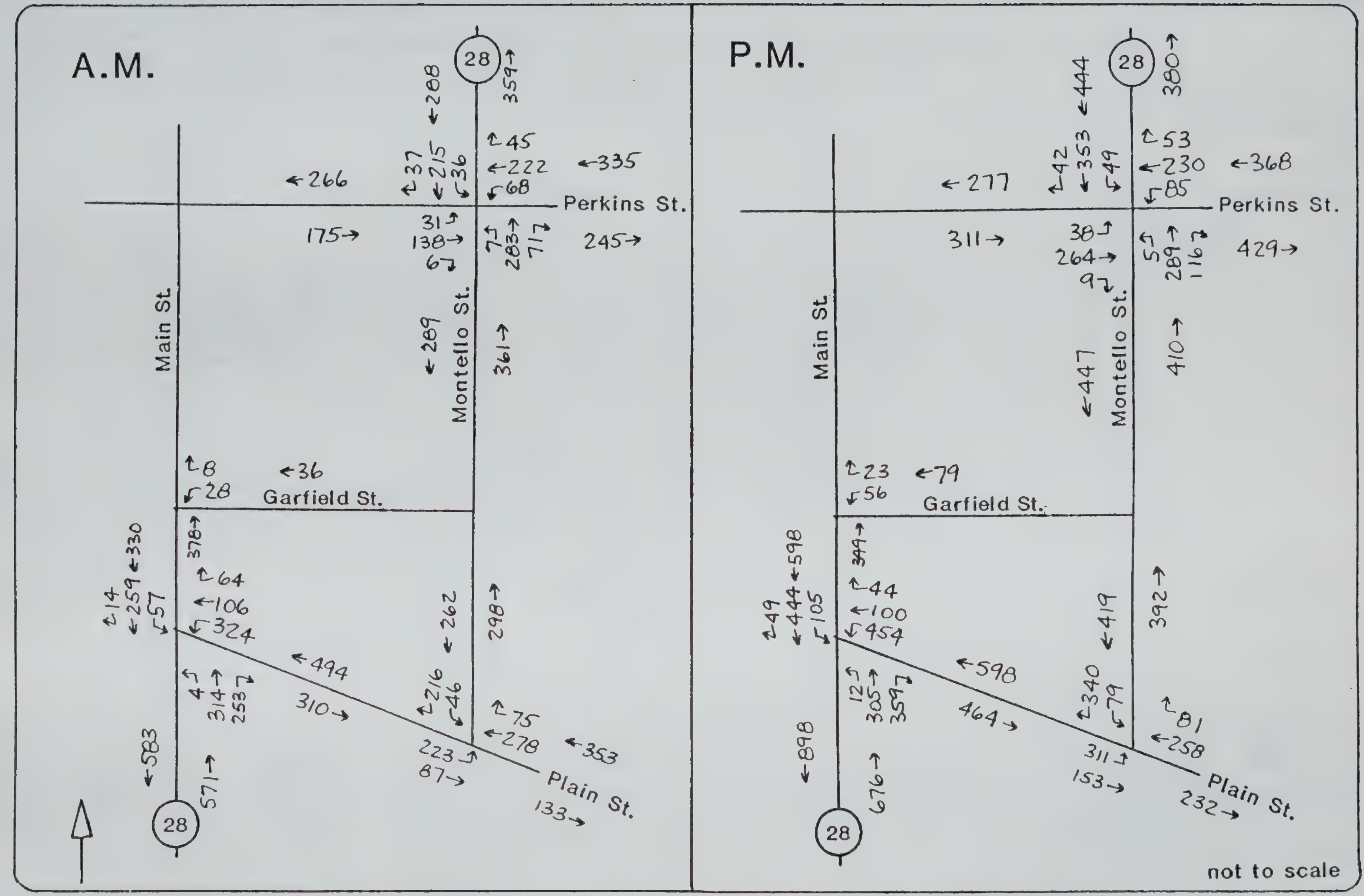
TABLE 9-2

Level of Service Analysis
Campello Station Area Intersections

Intersection	Now Signal-ized?	Level of Service: Year 2000 Traffic					
		without Campello Station		with Campello Station*			
				Scheme 1		Scheme 2	
		AM	PM	AM	PM	AM	PM
Main/Plain/Keith Ave.	YES	B	C	B	C	B	C
Montello/Plain St.	NO						
--Left turn Montello SB		B	E	D	E	D	E
Montello/Terminal Pl.	NO						
--Left turn Terminal WB		---	---	---	---	C	D
Montello/Perkins	YES	B	C	B	C	B	C

*existing street layout, traffic controls, assumed

NOTE: "Scheme 1" prohibits left turns out of Terminal Place, so that all SB traffic is routed via Plain Street exit. "Scheme 2" permits all moves from Terminal Place exit.



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Old Colony Railroad
Rehabilitation Project

FIG. 9-1
MIDDLEBOROUGH : Campello
Existing (1987) Traffic

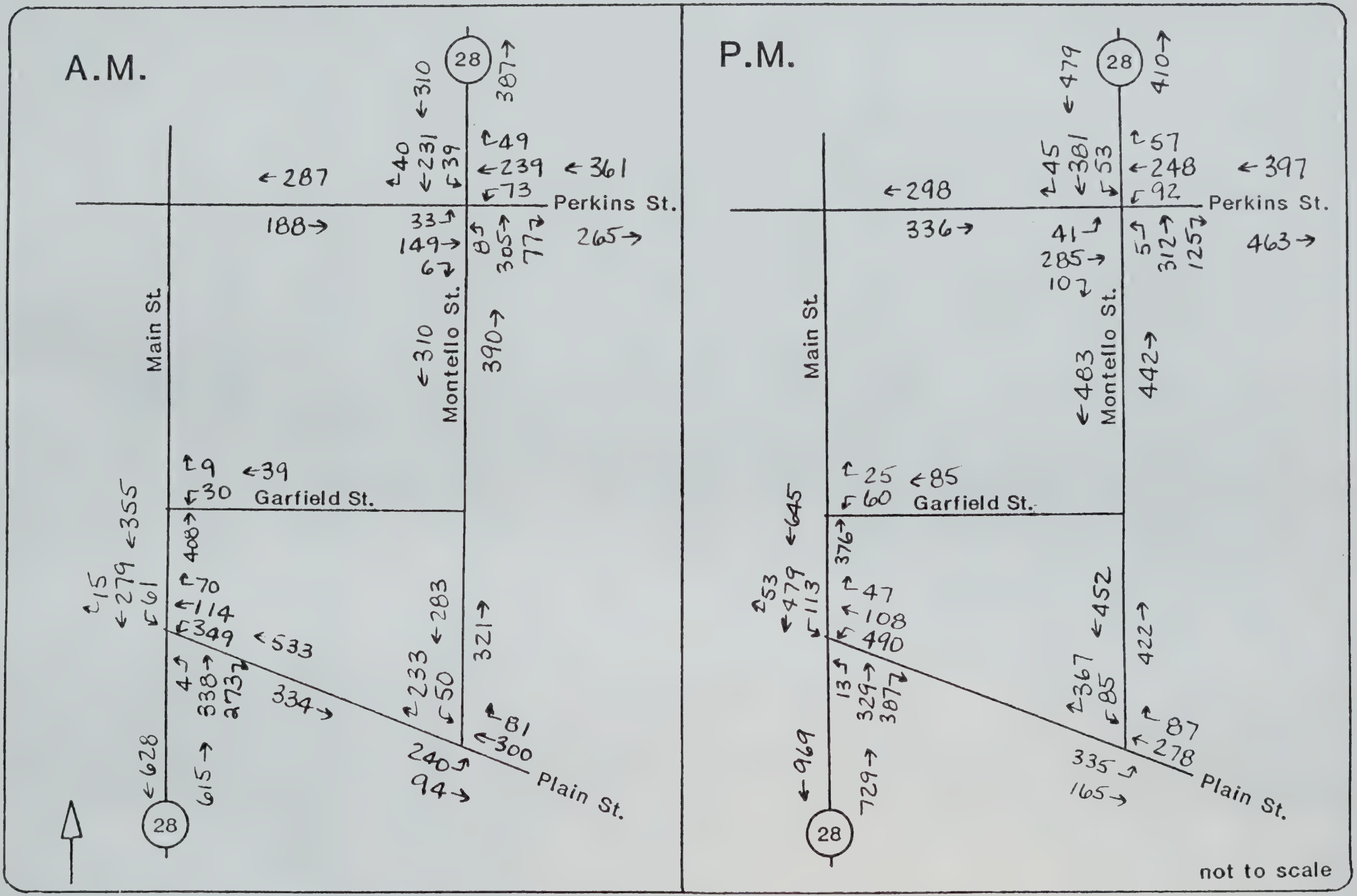

FIG 9-2
MIDDLEBOROUGH: Campello
YEAR 2000 Base Traffic

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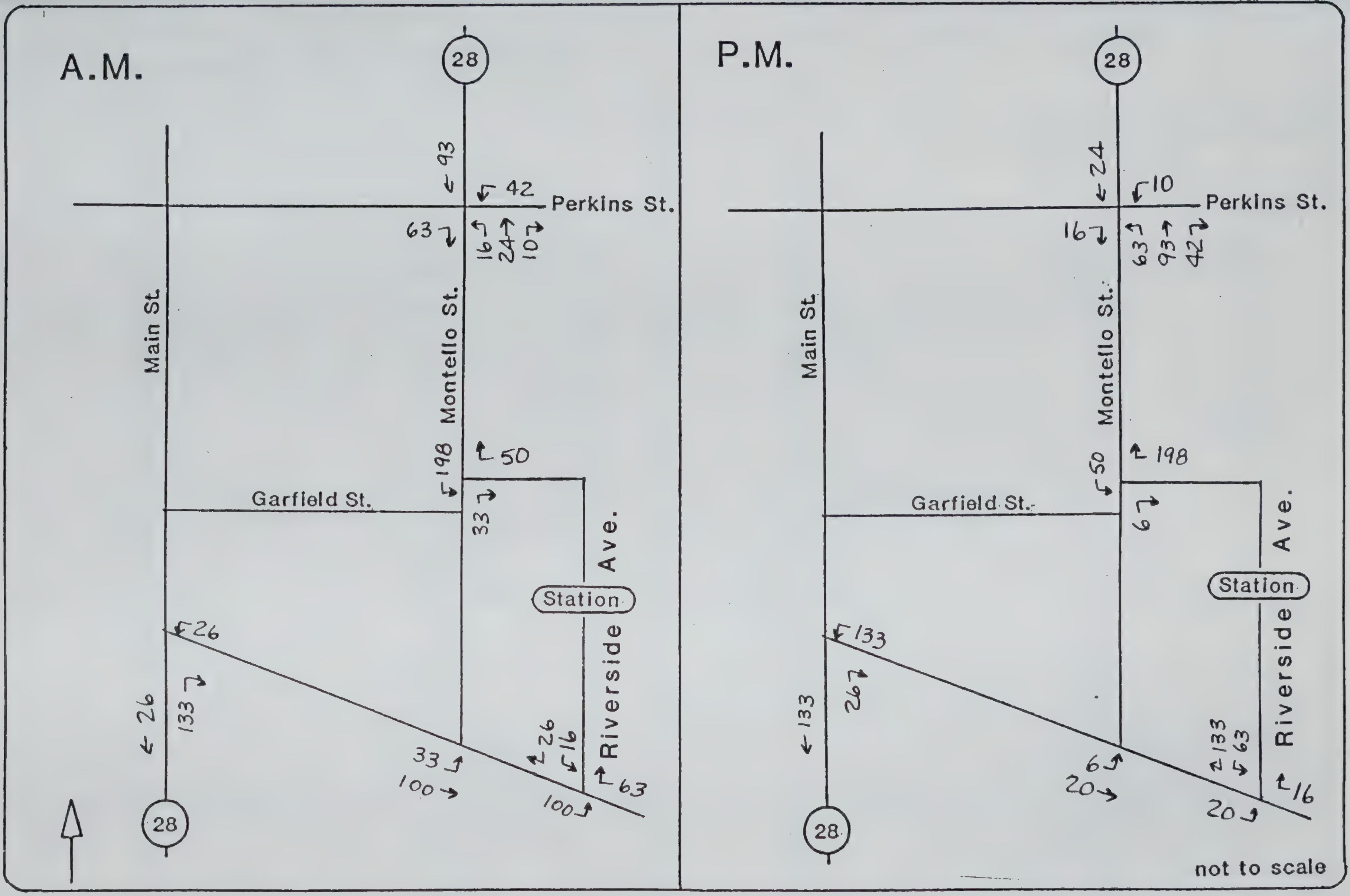
Rehabilitation Project



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Old Colony Railroad Rehabilitation Project

FIG 9-3a
MIDDLEBOROUGH: Campello
Station Traffic — "RIGHT-TURNS ONLY"
AT TERMINAL PLACE (Scheme 1)

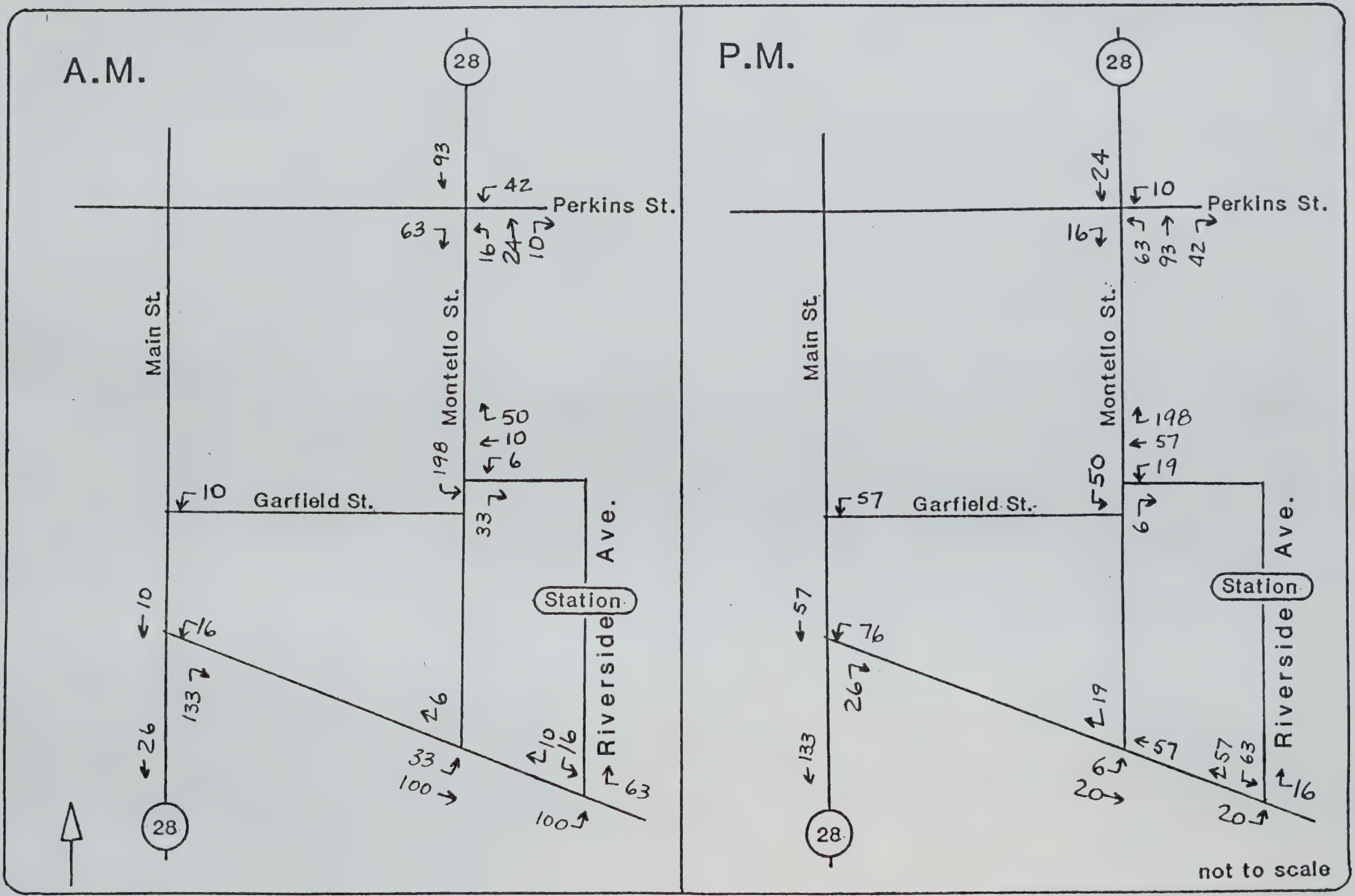

FIG 9-3b
MIDDLEBOROUGH: Campello
Station Traffic — All moves permitted
(Scheme 2)

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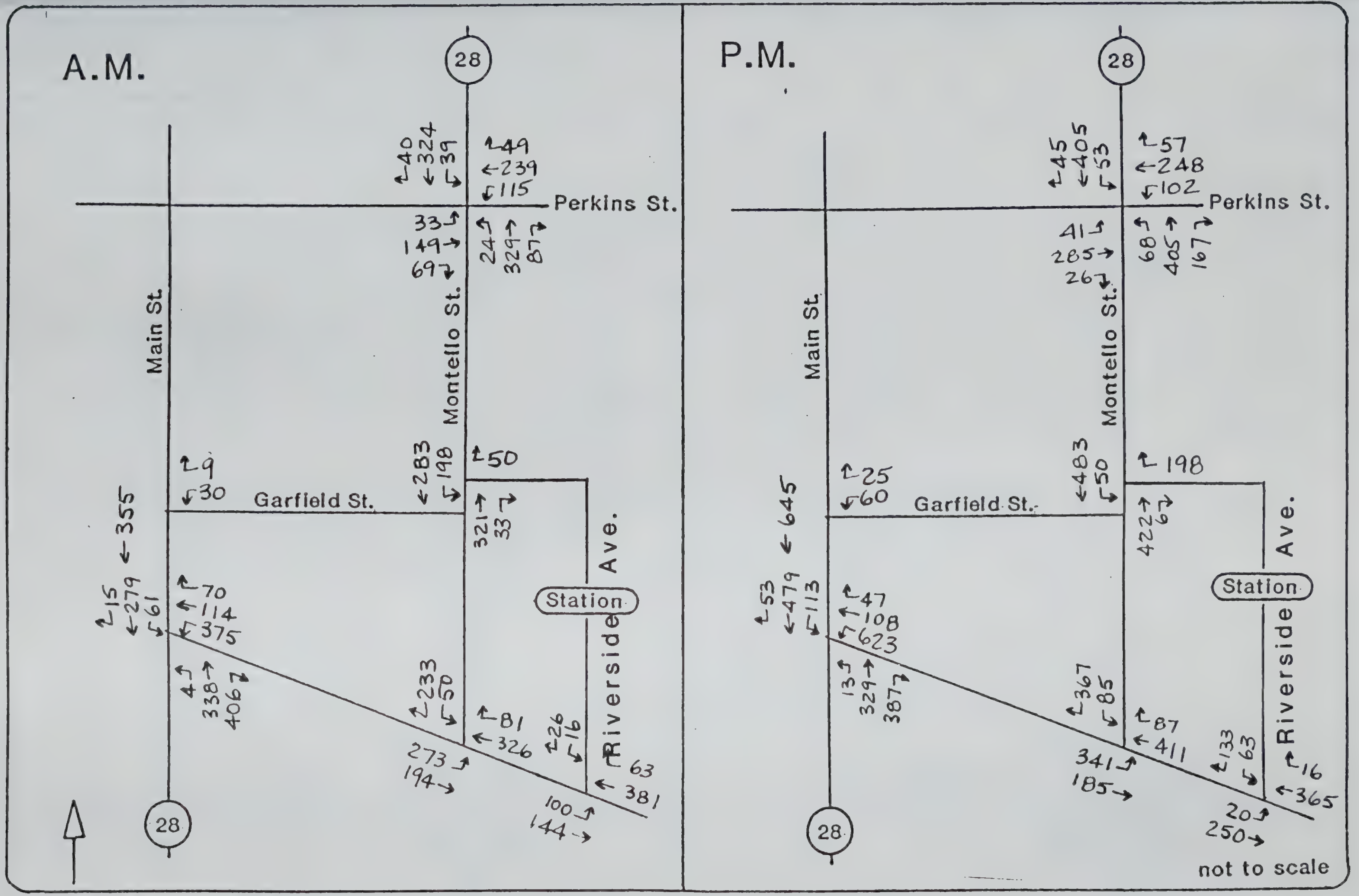

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FIG 9-4a
MIDDLEBOROUGH: Campello
Future Traffic with Station - "RIGHT-TURNS ONLY
(scheme 1)

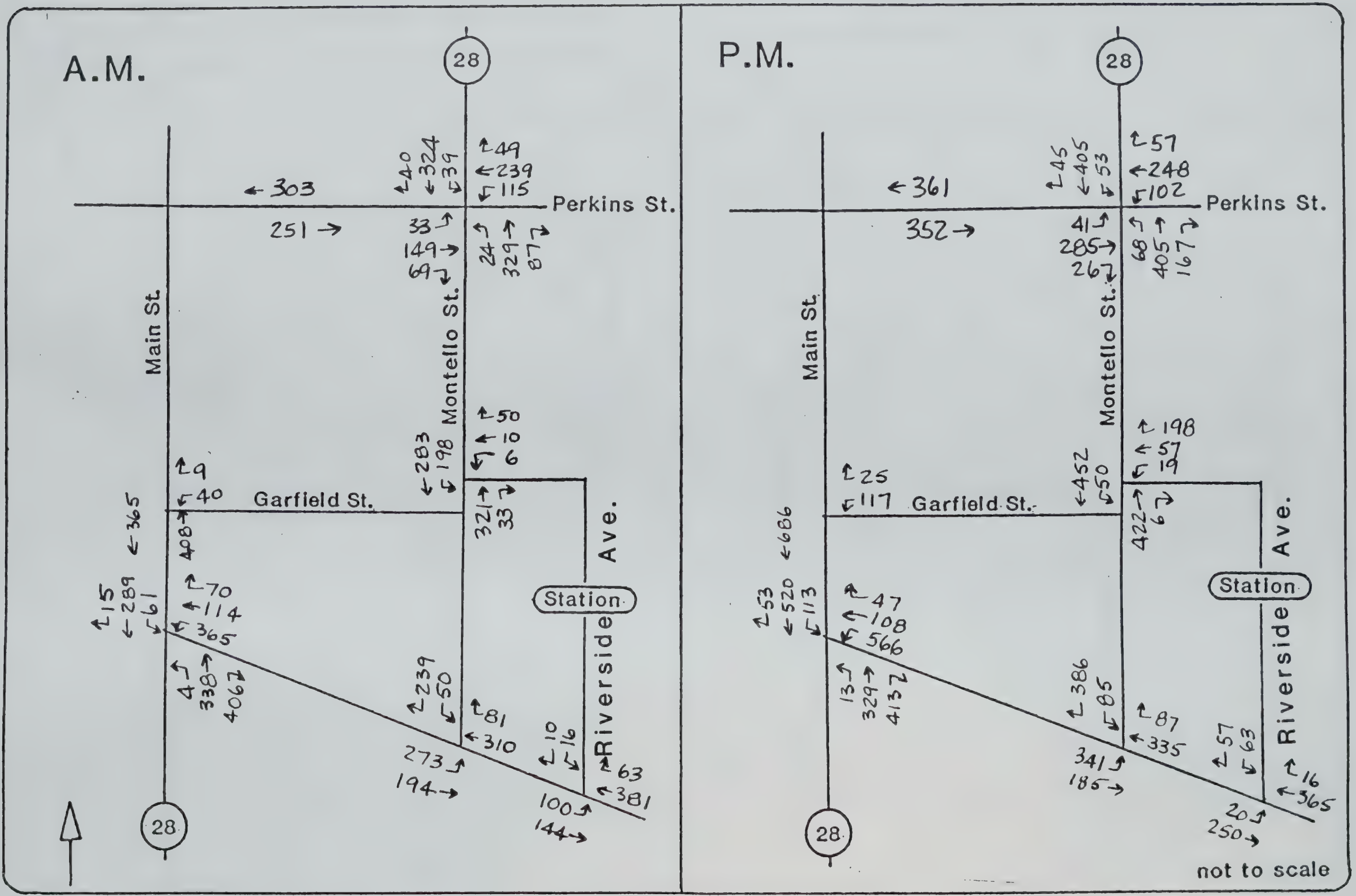

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FIG 9-4b

MIDDLEBOROUGH: Campello

Future Traffic, with Station – All moves

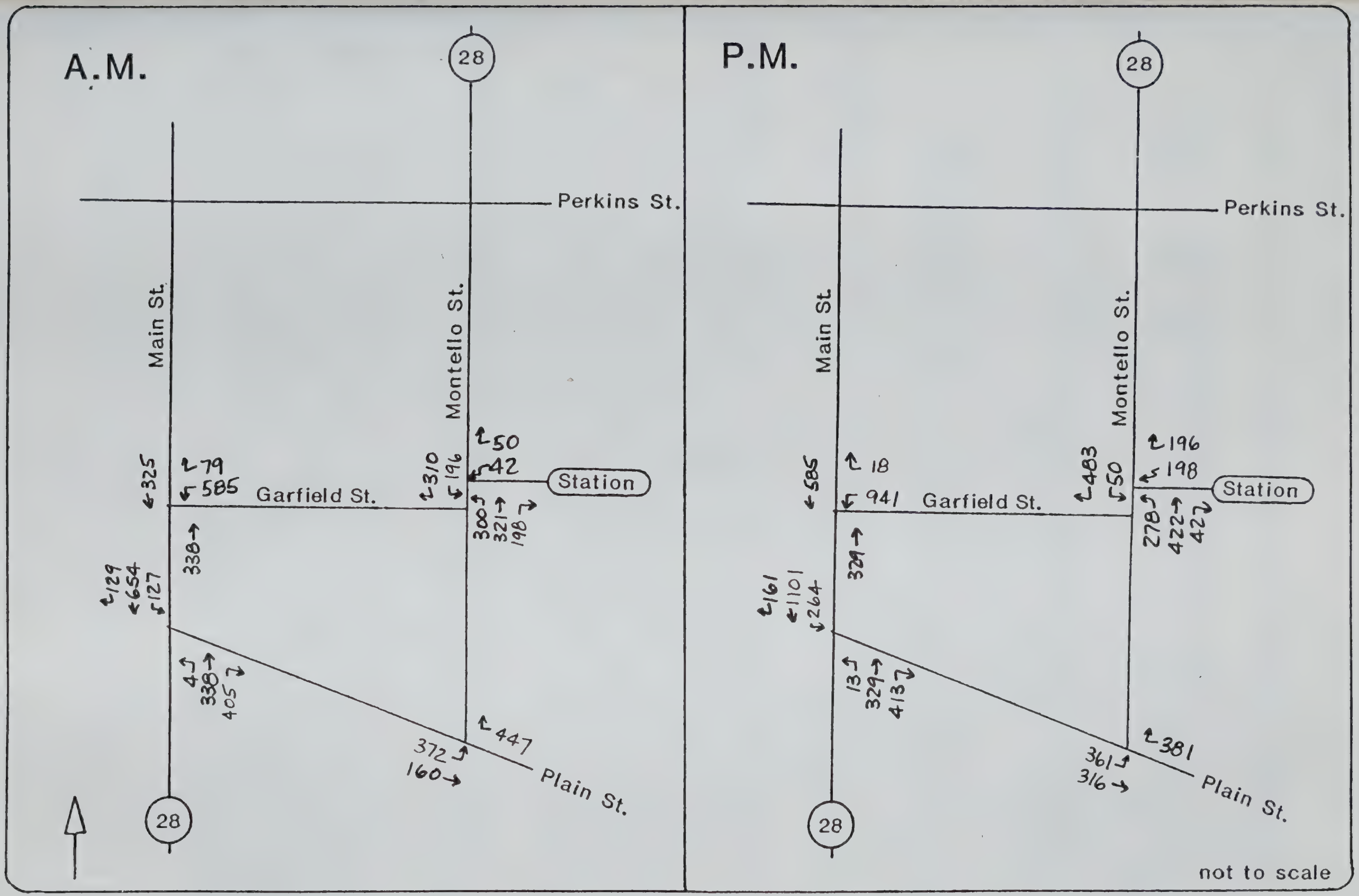

FIG. 9-5
FUTURE TRAFFIC: ONE-WAY CIRCULATION

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AUTHORITY

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Rehabilitation Project

10. Line Segment from Brockton-West Bridgewater Line to West Bridgewater-Bridgewater Line

Several station sites were examined in this segment and the conclusion reached that putting a station in this segment should be deferred. The only traffic impacts within this segment therefore are the traffic delays caused by train passbys at the two grade crossings in this segment.

The more northerly of this grade crossings, Matfield Street, is a low volume, two-lane roadway of rural character serving low density residential areas on both sides of the track. Queuing would be minimal to non-existent at train passbys.

The second grade crossing, West Street in East Bridgewater (Route 106) is also a two lane roadway. It is the principal connecting route between East Bridgewater to the east and Routes 24 and 28 to the west. It carries moderate levels of traffic. Queuing would occur as trains pass by during the peak period.

Analysis was performed to estimate the average and maximum length of queues and average delay per stopped vehicle at this crossing. The results of this analysis are presented in Table 10-1.

A key assumption contained in Table 10-1 is that heavy truck volumes are higher at this location than generally, because of the proximity of the Shaw's Supermarket distribution facility on Laurel Street, just east of the grade crossing. Counts of heavy truck activity, conducted in July 1987 during both AM and PM Peak Periods, showed heavy truck activity entering and exiting Laurel street in the morning hours. There were 18 and 16 trucks entering and leaving Laurel Street in the direction of the grade crossing during the AM Peak Hour. By comparison, PM peak period truck activity was limited to a few trucks. The evening peak period at Shaw's does not begin until about 9 PM (according to the Operations Manager at Shaws). Thus, it does not coincide with traffic or train peaks.

Consequently, an average vehicle length of 25 feet, instead of the 22 feet used elsewhere, was used to estimate average and peak vehicle queues during the morning peak hour only at the Route 106 grade crossing.

The closest intersections on either side of the track are East Street (2000 feet west of the track) and Laurel and Park Streets (305 feet and 640 feet east of the track, respectively). To the east, vehicle queues associated with the grade crossing closure will regularly extend along Route 106 beyond Laurel Street, and will occasionally extend as far as Park Street, a short residential street which connects West Street and Spring Street. Short blockages of Laurel Street (and more rarely, Park Street) are acceptable, since volumes out of Laurel Street are not high. There were 55 right turns, 40 left turns, from Laurel to Route 106 counted during the AM Peak Hour, July 1987.

TABLE 10-1

Queuing Analysis: Route 106 Grade Crossing

	Peak Hr. Approach volume	Average 90-Sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length (ft.)*
AM Peak Hour				
Route 106 EB	389	10	15	375
Route 106 WB	771	19	24	600+
PM Peak Hour				
Route 106 EB	817	20+	25+	550+
Route 106 WB	471	12	17	375

*analysis assumes higher-than-average truck percentage, so average vehicle length is 25 feet instead of 22 feet assumed at other locations.

11. Bridgewater Station and Line Segment from West Bridgewater Town Line to Middleborough Town Line

This segment of the Middleborough Branch, extending from the West Bridgewater Town Line to Middleborough Town Line, includes a proposed new station, to be located on the campus of Bridgewater State College.

In addition to the station, 7 existing grade crossings in this section will cause traffic delays: at Wall, Oak, Broad, Plymouth, Laurel, Flagg and Titicut Streets. The 2 closest-spaced crossings are at Broad and Plymouth Streets, about one-quarter mile apart. As part of the rail project, an additional grade crossing would be constructed on a new station access roadway, approximately one-half mile south of the existing Plymouth Street crossing, so that the total number of vehicular grade crossings in this section will be eight.

Finally, a new at-grade pedestrian crossing would be included just north of the platform at the Bridgewater State College station, to supplement the existing pedestrian bridge.

11a. Streets and Intersections

Bridgewater Center is at the conjunction of 3 numbered routes (Routes 18, 28, and 104), which come together in a busy signalized intersection in the center of town. This intersection has been improved several times over the past 20 years. It currently operates as a 5-way intersection with 2 one-way legs which route traffic around an elongated grassy island/green which divides the Central Business District in half. The existing traffic signal at this location is an actuated multi- phase signal with a dual-ring controller, and a pre-emption sequence which can be activated by the Fire Department.

Each of the 3 numbered routes operates as a suburban arterial outside the Bridgewater Center area, generally with one travel lane in each direction and a speed of 35-45 mph. Within the Center area, however, all operate as local streets, with on- street parking, and frequent intersections and curb cuts.

The island/green in the town center separates the NB and SB sides of Routes 18 and 28, with angle parking provided around the outside to service the Center's merchants. Also, several large parking areas exist in the area adjacent to shopping centers and supermarkets.

Route 104 east of Bridgewater Center (Plymouth Street) provides access to Summer Street and the Bridgewater State campus buildings on the west side of the track; and to Burrill Avenue and the large student parking lot east of the track.

The centers of campus administration and activity, as well as faculty and administrative parking, are located on both sides of Summer Street south of Park Street; so that there is significant turning traffic from Plymouth Street into and out of Summer Street.

Farther east along Plymouth, Burrill Avenue and Hooper Street currently provide the only access to and from the 1500-car student lot, which generates its greatest activity on Monday, Wednesday and Friday mornings early in the Bridgewater State school term. According to a traffic study performed by the Old Colony Planning Council (OCPC) in 1984, most of the traffic destined for the lot is coming from north of Bridgewater. This traffic uses Route 18, Route 28, and the cross-streets connecting these routes directly with Plymouth Street north of Bridgewater Center (Hale Street, Spring Street, etc.), as well as the central Town intersection.

The current official pedestrian access from the student parking lot to the main college buildings is a high bridge located at the northern end of the lot. Most students would prefer to cross the tracks at grade. A peak pedestrian crossing count of over 600 persons in the 15-minute period 8:45-9:00 AM was observed during the traffic count program at this station site. Numerous attempts to fence off the track or otherwise control at-grade access have had only short-term success.

West of Bridgewater Center, Route 104 becomes South Street, and makes a 90-degree turn at Pleasant Street, at a location controlled only by a stop sign.

South of the more southerly Park Street intersection, Summer Street is residential and suburban in character, carrying relatively little traffic. The proposed new driveway providing access to the student parking lot would be located off Summer Street approximately 500 feet south of Park Street, at the location of the existing Observatory access driveway.

11b. Existing Traffic

Bridgewater State traffic is recognized by the Town and the college to be a significant component adding to local congestion, particularly during the morning peak period. Long queues develop on all approaches to Burrill Avenue, including Spring Street and Plymouth Street in each direction. During recent traffic counts in the Center, Burrill Avenue was not being used for morning access at all. Student lot traffic was diverted to the Hooper Street entrance.

AM and PM Peak Period turning movement counts were undertaken at numerous locations around Bridgewater Center and the College in October 1987 during the first few weeks of the school term. Students from the College assisted in this counting effort, so that all locations were covered during a single day. These counts were used to supplement earlier counts performed by this consultant in 1986, and by OCPC in 1984. The resulting estimates of existing Bridgewater traffic under peak school conditions are presented in Figure 11-1a and 1b.

At one location, counts were available both during summer months and at the beginning of term (Plymouth Street at Spring St.). Here, volumes counted during the fall were over twice the summer counts for the AM Peak Hour, and were 30 percent higher than summer counts during the PM Peak Hour.

Level of Service analysis based on peak-season volumes was performed for representative intersections in the Bridgewater Center area; the results are illustrated in Table 11-1. For 3-way intersections, only the LOS value for left turns from the minor to the major street are shown; all other values were calculated to operate at Level of Service "A".

11c. Future Growth Assumptions

For purposes of the present analysis, assumed Year 2000 base traffic volumes were computed by factoring existing traffic using an assumed growth rate of 1 percent per year, uncompounded. Bridgewater State College officials anticipate modest growth in enrollment between now and Year 2000; but the College is attempting to attract new resident students, rather than commuters. Consequently, growth in college-oriented vehicular traffic is not expected to occur at a faster rate than general area traffic growth.

The existing circulation and parking lot arrival patterns were assumed to remain as at present, in the absence of a railroad station. The resulting Year 2000 base traffic volumes are shown in Figure 11-2a and 2b, while Table 11-1 provides a summary of LOS analysis applied to each location. Increased traffic volumes results in reduced LOS, particularly for left turns and through traffic at unsignalized intersections both north and south of Bridgewater Center.

11d. Station Traffic

Patronage forecasts for a railroad station at the existing student parking lot, by mode of access, were produced for 4 rail alternatives, as described in Section B (Methodology). For this station, forecasts for Middleborough commuter rail only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 174 daily parkers, 73 daily drop-offs.

Bridgewater State College, in conjunction with BAT, currently provides shuttle bus service in Bridgewater and surrounding towns, principally for College students and personnel but open to townspeople as well. Shuttle bus service would also be provided to a rail station at this location. Bus operations are not included in vehicle arrivals for the purposes of this analysis, however.

Peak hour vehicle arrivals and departures are estimated at 60 percent of daily arrivals; or 104 parking vehicles arriving AM, departing PM, and 44 drop-off vehicles, 88 vehicle-trip ends, entering and exiting the station in each peak hour. All station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already passing through Bridgewater Center.

The distribution of arrivals, based on towns of origin, are as shown on Figure 11-3a and 3b. Most vehicles arriving at the station from the south were assumed to use the proposed second access route from Summer Street. Station traffic from the north was assumed to use the Hooper Street entrance.

In addition to distributing station traffic, existing access patterns to the student parking lot were altered to reflect the newly-created entrance on Summer Street. Since most of the College traffic is believed to originate north of Bridgewater, this entrance is less useful to College traffic than to rail patrons. Nevertheless, the redistribution does affect significant numbers of vehicles. Figures 11-4a and 4b show the existing and estimated future arrival distributions for student traffic to the lot.

Total Year 2000 traffic volumes represent the sum of a) base volumes; b) rerouted student traffic, given a Summer Street entrance; and c) rail patron traffic. These volumes are depicted in Figure 11-5a and 5b. As a result of the new entrance, some locations gain traffic, while others experience net reductions in Future traffic compared with the Base Case. In particular, intersections close to Burrill Avenue and Hooper Street tend to improve, while locations south of Bridgewater Center tend to experience greater delays and congestion.

Several 4-way intersections south of the Center, presently controlled by stop-signs, are particularly impacted by increased traffic. These include Bedford/Grove Streets, and South/ Prospect/Grove Streets. These are locations which are already candidates for traffic signalization, as is the 3-way intersection of South/Pleasant Streets. Under the future rail scenario, these intersections are further impacted, primarily by rerouted college traffic rather than by station traffic.

Level-of-Service results for each intersection under future volume conditions are shown in Table 11-1. Again, only left turns out of minor streets are reported for 3-way intersections. The principal beneficial effect of a new parking lot driveway south of the Center is felt at Plymouth/Hale and Plymouth/Summer Streets during the AM Peak Hour. The principal negative impact is felt at Summer/Grove Street during the PM Peak Hour, as station traffic from the Summer Street station exit turns left towards Route 104 (Pleasant Street).

11e. Grade Crossings

Freight Service currently operates on the Middleborough Line so that grade crossing controls already exist at all 7 of the existing crossings, and their operation is generally familiar to local drivers.

Of the 7 existing grade crossings in this segment, the most critical are at Broad and Plymouth Streets, close to downtown Bridgewater. The other 5 grade crossings are located on comparatively minor streets carrying low volumes, and tend to be located away from critical intersections.

1) Queues at Track

The Broad Street crossing is located in front of the former station site at Spring Street, at a point where a large number of SB vehicles presently turn left onto Spring Street to reach the Burrill Avenue/Hooper Street parking lot access driveways. The Plymouth Street crossing is regularly blocked by EB or WB vehicle queues (in the AM and PM Peak Hours respectively) heading toward or away from Burrill Avenue/Hooper Street. Afternoon departing traffic is much less intense than arriving morning traffic, so that the afternoon peak period is less critical.

A new vehicular grade crossing on the proposed Summer Street access roadway will be used only by parking lot traffic, both students and commuters. No on-street queuing problem is envisaged here. Also, as part of the train station, at the request of the College the MBTA proposes to supplement the existing pedestrian bridge over the track with an at-grade pedestrian crossing. Such a crossing would be located north of the station platform, and would itself be equipped with warning bells and gates.

With Old Colony commuter service through this built-up area, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. The schedule currently envisaged calls for half-hour commuter-train headways on the Middleborough Line during peak hours, with other activities (freight, Cape trains) restricted to off-peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

Using future traffic projections, estimates were made of average and "peak" queue lengths in both directions on Broad Street and Plymouth Street for both AM and PM Peak Hours. These are presented in Table 11-2. None of the crossings is currently within 200 feet of a signalized intersection, and no signals are currently proposed for any locations close to a grade crossing. Consequently, signal pre-emption is not an issue here.

At the Broad Street crossing, exiting Spring Street traffic turning left towards Bridgewater Center will also be blocked by gate closures; but most of the traffic using Spring Street in this direction turns right at the intersection. There is ample room at the Spring Street approach to Broad Street for left- and right-turning vehicles to queue separately, and for right-turning vehicles to pass, unobstructed by gate closures.

On the northbound Broad Street approach to the track, the only intersection which is likely to experience occasional blockage by vehicle queues is at Hale Street, approximately 500 feet south of the track. Because such blockage will be rare, affecting 1 or 2 side-street vehicles at most, it is not considered to be a problem.

2) Queues at Intersections Downstream of Track

The major Bridgewater Center intersection at Central Square is over 1000 feet away from the railroad right-of-way, and is not in any danger of being blocked by vehicles queuing away from either the Broad Street or Plymouth Street crossing in either peak hour.

The Plymouth Street crossing is located just over 200 feet from the Burrill Avenue parking lot entrance. Currently, vehicle queues extend from the intersection of Plymouth and Summer Streets almost as far as Burrill Avenue in the PM Peak Hour. This condition will be relieved somewhat by provision of a second, southerly entrance to the student lot, because traffic from south of the Center will no longer use Plymouth and Burrill Streets. But queues will continue to develop across and away from the track at the Plymouth Street crossing.

Signalizing Plymouth/Summer Streets with railroad pre-emption would ameliorate this problem to a small degree, if a WB left-turn lane were provided and given priority during the track clearance interval. If the bottleneck causing vehicles to queue is at Central Square, however, rather than at Plymouth/Summer, signalizing the latter intersection would not improve matters.

The available queuing distance between Bridgewater Center and the track is approximately 1300 feet, which is enough room to store about 62 vehicles in a single lane. Given an arrival rate of 430 + 83 vehicles queuing back from the Center stop line, the average arrival rate per 90-second cycle is 13 vehicles, of which up to two-thirds are stopped by a red indication. The maximum likely arrival rate is about 18 or 19 vehicles per 90-second period, which is still well clear of the Plymouth/ Summer Street intersection. Consequently, it appears that left-turns from Plymouth onto Summer Street are the source of the existing queues across the track, rather than backups from the Center. In this case, signalizing Plymouth/Summer may greatly improve the WB queuing situation across the grade crossing.

In the EB direction, signals at Plymouth/Summer will hold EB volumes from Bridgewater Center at the former intersection while allowing right turns from Summer Street to proceed. This will cause queue backups toward Bridgewater Center. The maximum likely queue is about 18 vehicles in the PM Peak Hour, or about 400 feet, which, again, is clear of the upstream intersection.

It is recommended that the College continue to restrict inbound Burrill Avenue access to the lot during peak periods, and to direct incoming traffic farther east along Plymouth Street, to Hooper Street.

It should be noted that, in both EB and WB directions along Plymouth and Summer Streets, anticipated traffic volumes with a station are considerably lower than under No-Build assumptions, because of the relief provided by the new Summer Street entrance. Consequently, vehicle queues in both directions along Plymouth Street would be shorter than under No-Build, and, in the AM Peak Hour, shorter than current queues.

11f. Mitigation Measures

The following measures are recommended to improve traffic flows and ease delays associated with railroad and student parking lot operations:

- Existing grade crossing controls--upgrade existing gate controls at all grade crossings; install new, fully-automatic gate controls where these do not presently exist.
- Traffic signals--perform warrant analysis and install traffic signals at locations where warranted. Principal candidate locations:
    - Bedford/Grove
    - Pleasant/South
    - Summer/Grove
    - South/Grove/Prospect
- Install traffic signal, with railroad pre-emption, at Plymouth/Summer Streets.

- Review existing signal installation in Central Square; adjust timing intervals if necessary.

- Street improvements--provide a WB left-turn lane on Plymouth Street at the intersection with Summer Street. Rebuild Summer St. NB approach to this intersection, removing 1 island and striping and marking left and right turn lanes. Construct access roadway from Summer Street into parking lot, with new grade crossing. Provide SB left-turn lane on Summer Street at lot entrance. Plans for these street improvements are shown in the DEIS chapter IX, Figures IX-C8 and IX-C9.

TABLE 11-1

Level of Service Analysis
Bridgewater Center Area Intersections
(All Currently Unsignalized)

			Level of Service: Year 2000 Traffic			
	Existing		without OC commuter station		with OC commuter station (w/o mitigation)	
Intersection	AM	PM	AM	PM	AM	PM
Plymouth/Spring*	F	F	F	F	F	F
Plymouth/Hale*	D	D	E	D	D	D
Plymouth/Summer*	D	F	E	F	D	F
Summer/Grove*	B	B	B	D	B	F
Summer/Station Driveway*	--	--	--	--	D	A
South/Pleasant*	F	F	F	F	F	F
South/Grove/ Prospect						
Grove--LT out	E	F	F	F	F	F
Grove--TH-RT out	D	D	E	E	E	D
Prospect--LT out	E	E	E	E	E	E
Prospect--TH-RT out	C	D	E	E	E	E
Plymouth/Summer, with traffic signal	--	--	--	--	B	B
South/Grove/ Prospect, with traffic signal	--	--	--	--	B	B

* left turns out of minor street; all other moves are LOS "A"
-- not calculated

TABLE 11-2

Queuing Analysis: Broad Street and Plymouth Street Grade Crossings

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Broad Street					
--Northbound					
AM Peak Hour	422	11	16	350	56
PM Peak Hour	505	13	18	395	58
--Southbound					
AM Peak Hour	721	18	23	505	63
PM Peak Hour	714	18	23	505	63
2. Plymouth Street					
--Northbound					
AM Peak Hour	407	10	15	330	55
PM Peak Hour	702	18	23	505	63
--Southbound					
AM Peak Hour	579	15	20	440	60
PM Peak Hour	559	14	19	420	59

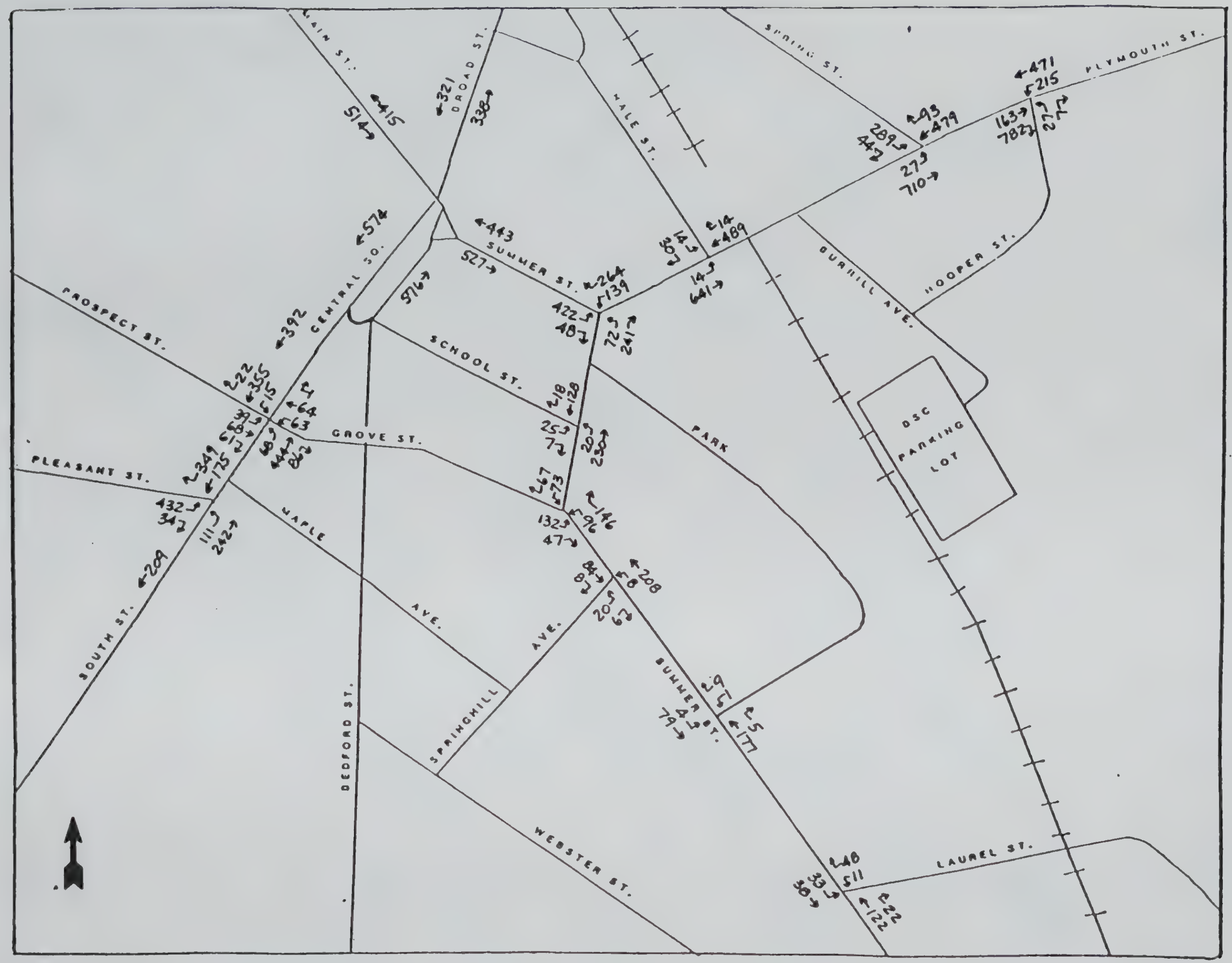


FIG. 11—1a

MIDDLEBOROUGH: BRIDGEWATER

EXISTING TRAFFIC—

AM PEAK HOUR

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

Old Colony Railroad
Rehabilitation Project

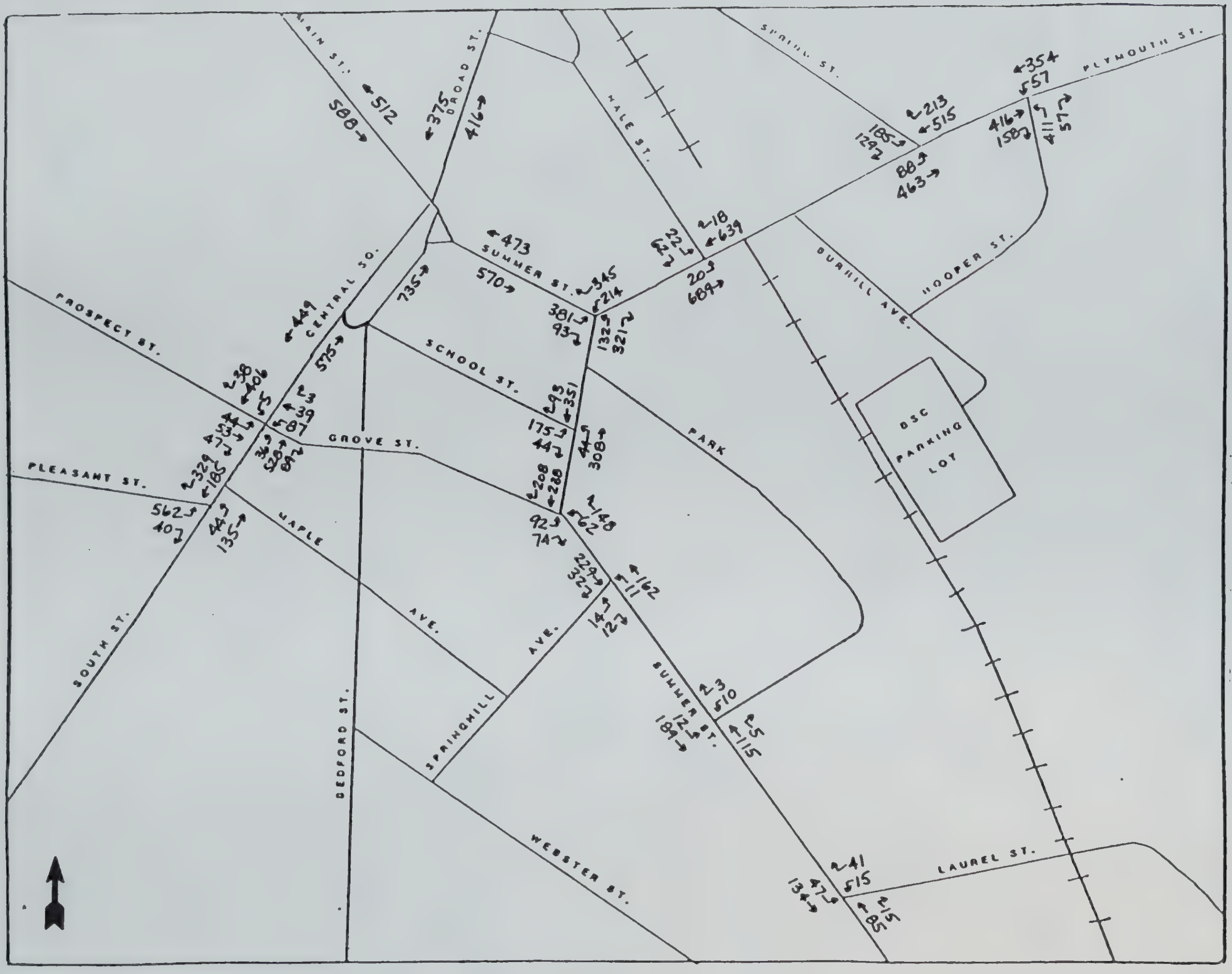


FIG. II-1b

MIDDLEBOROUGH: BRIDGEWATER

EXISTING TRAFFIC —

PM PEAK HOUR

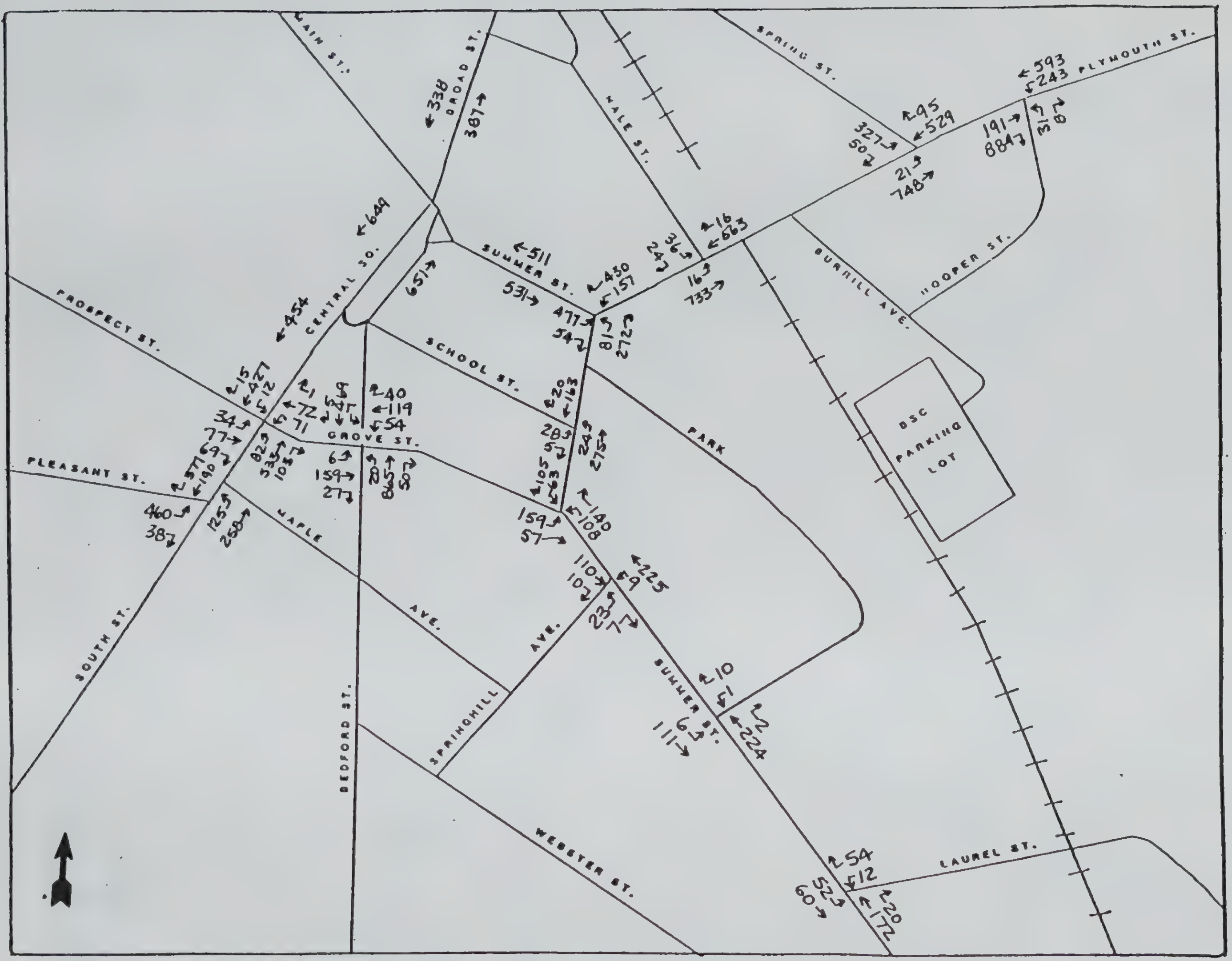


FIG. 11-2a
MIDDLEBOROUGH: Bridgewater
YEAR 2000 BASE TRAFFIC —
AM PEAK HOUR

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

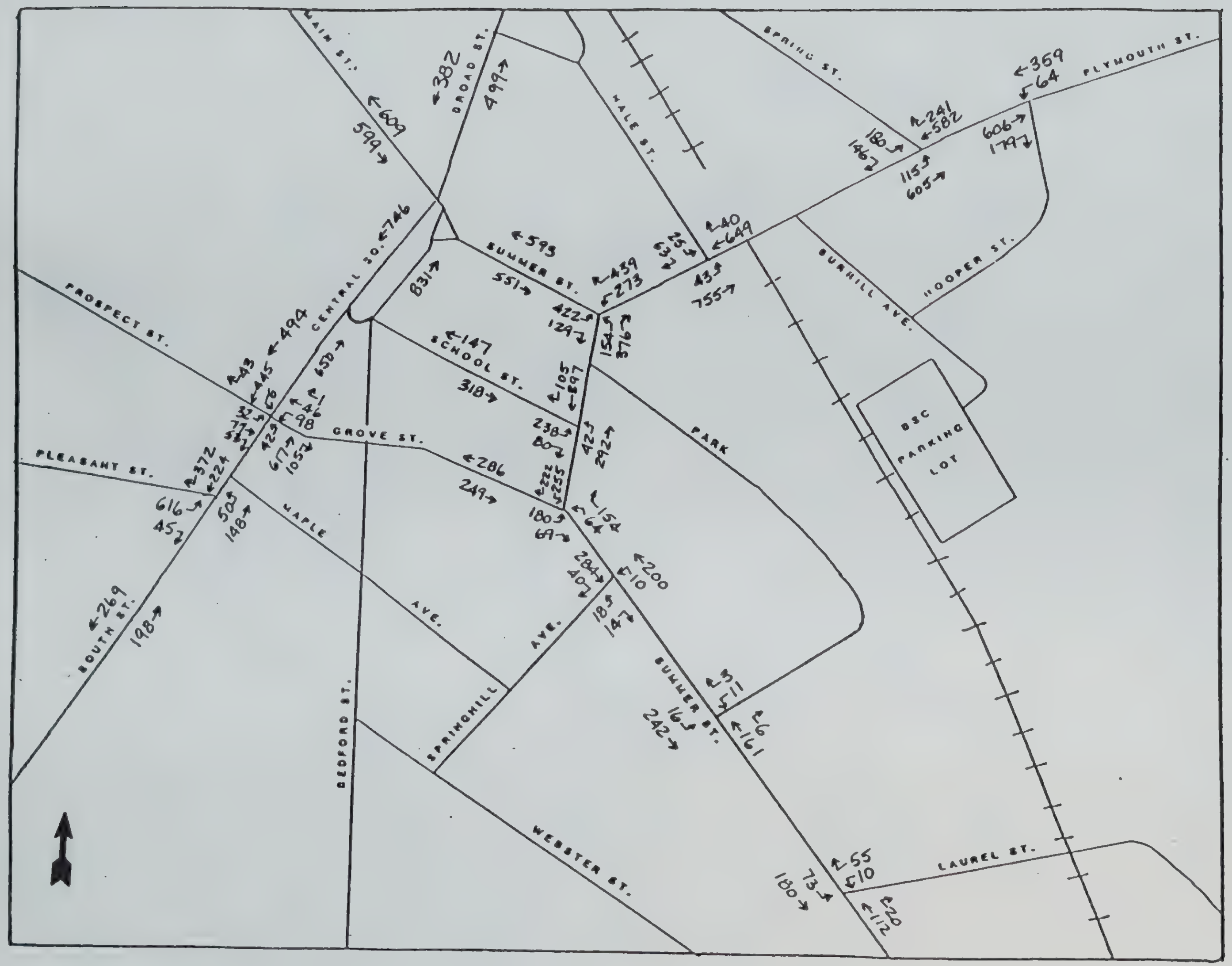
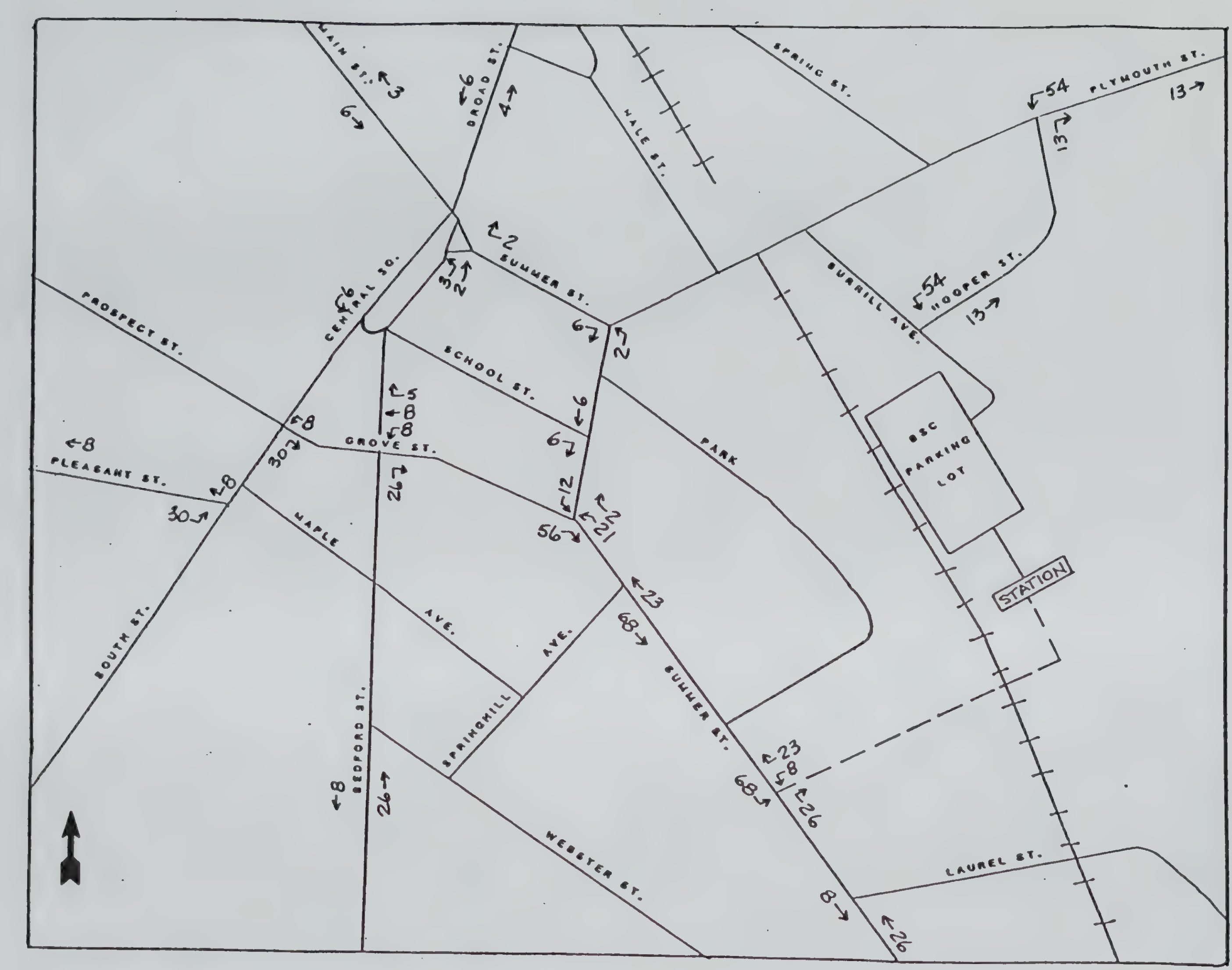


FIG. 11-2b
MIDDLEBOROUGH: Bridgewater
YEAR 2000 BASE TRAFFIC–
PM PEAK HOUR

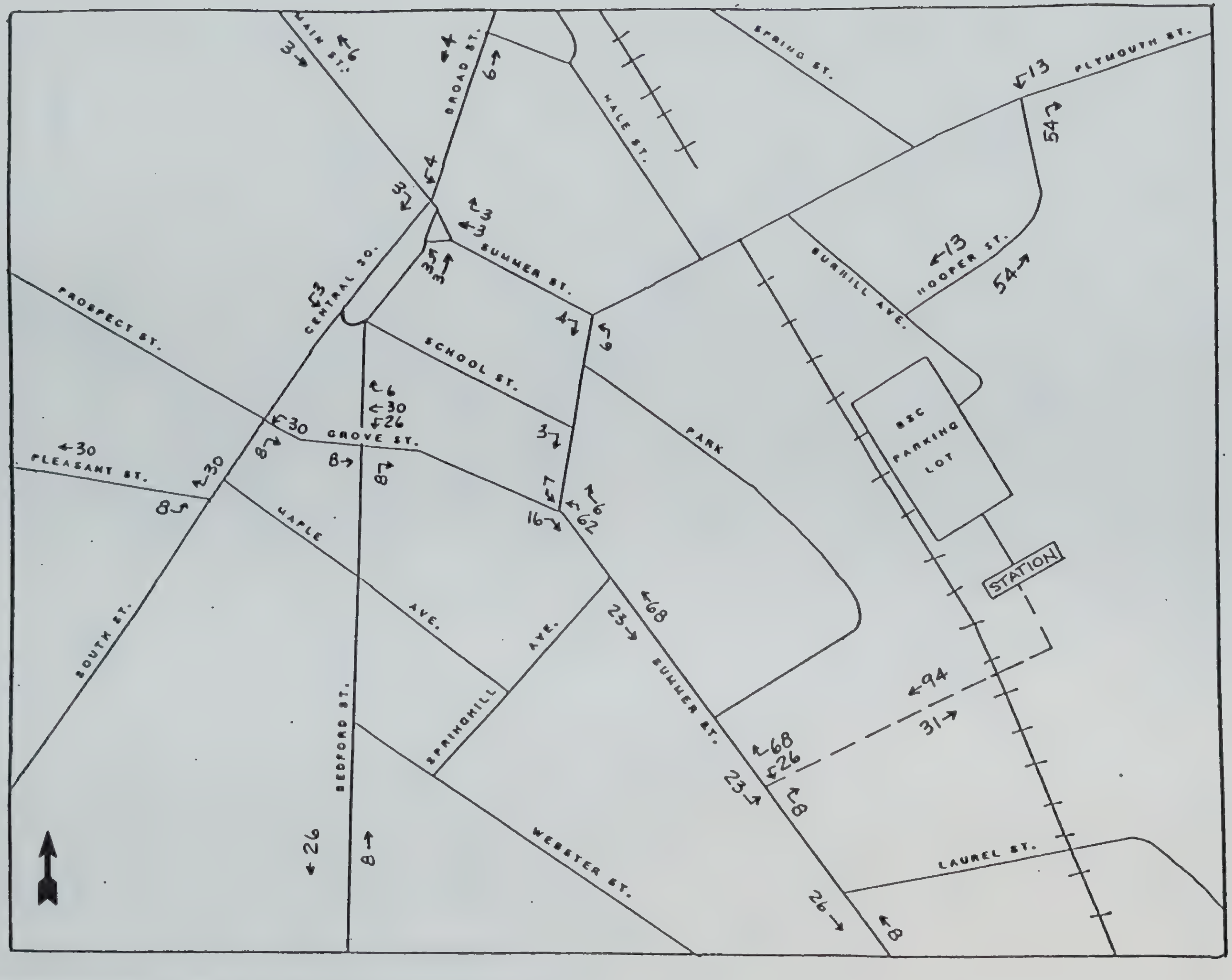
FIG. 11-3a
MIDDLEBOROUGH: Bridgewater
Station Traffic - AM Peak Hou



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

FIG. 11-3b
MIDDLEBOROUGH:, Bridgewater
Station Traffic - PM Peak Hr



MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Old Colony Railroad Rehabilitation Project

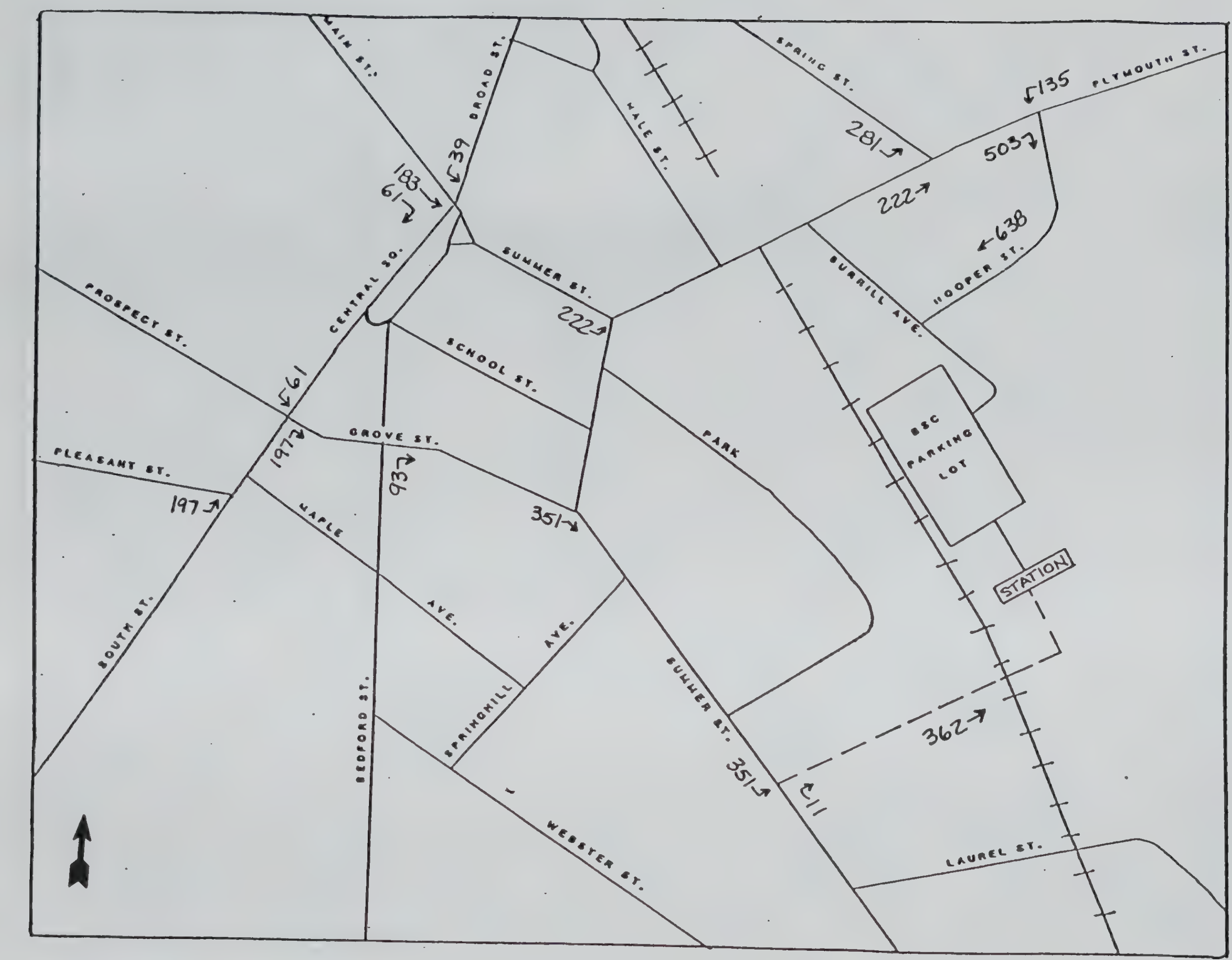


FIG. 11-4a
MIDDLEBOROUGH: Bridgewater
Rerouted BSC Traffic –
AM PEAK HOUR

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

Old Colony Railroad
Rehabilitation Project

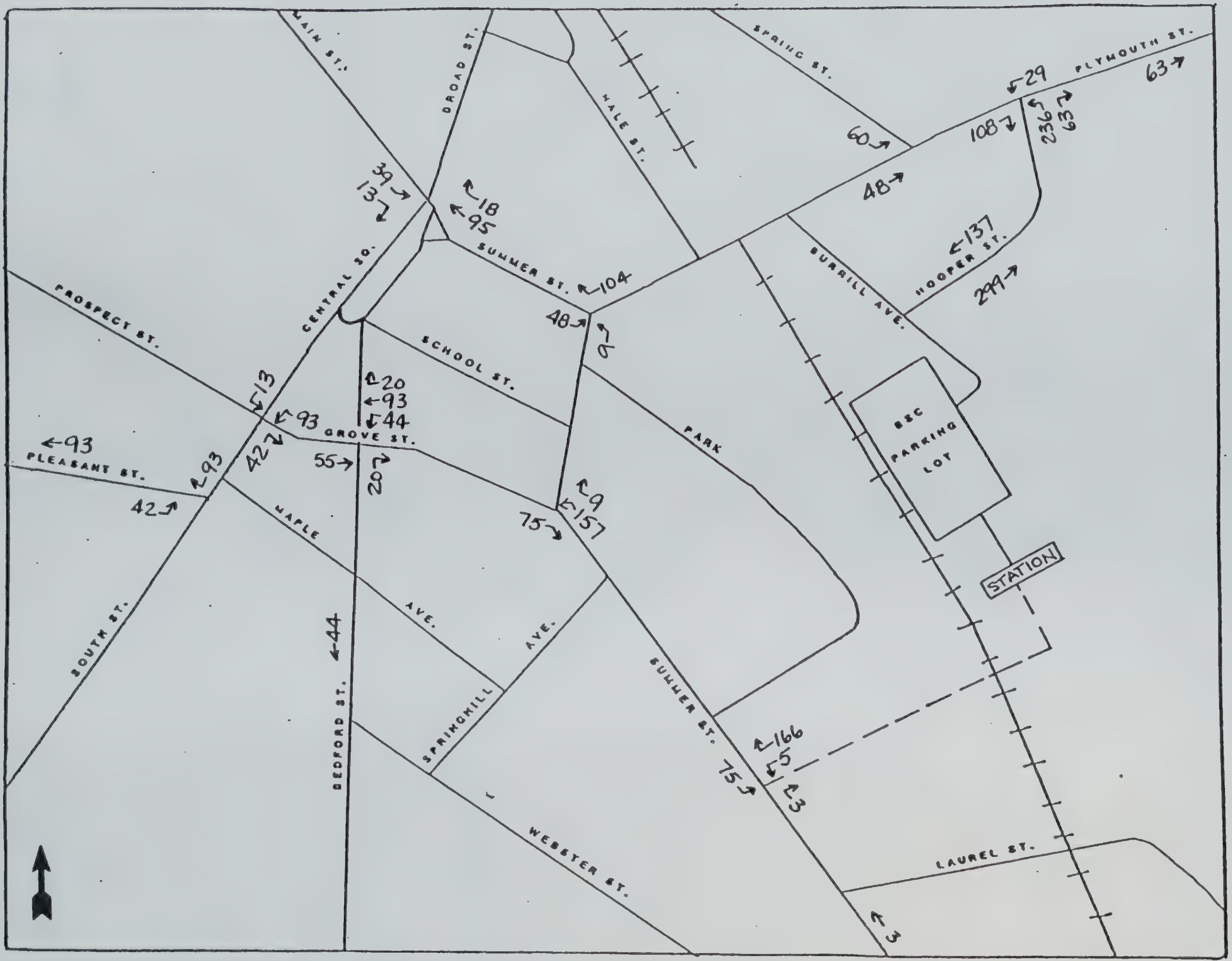


FIG. 11-4b
MIDDLEBOROUGH: Bridgewater
Rerouted BSC Traffic —
PM Peak Hour

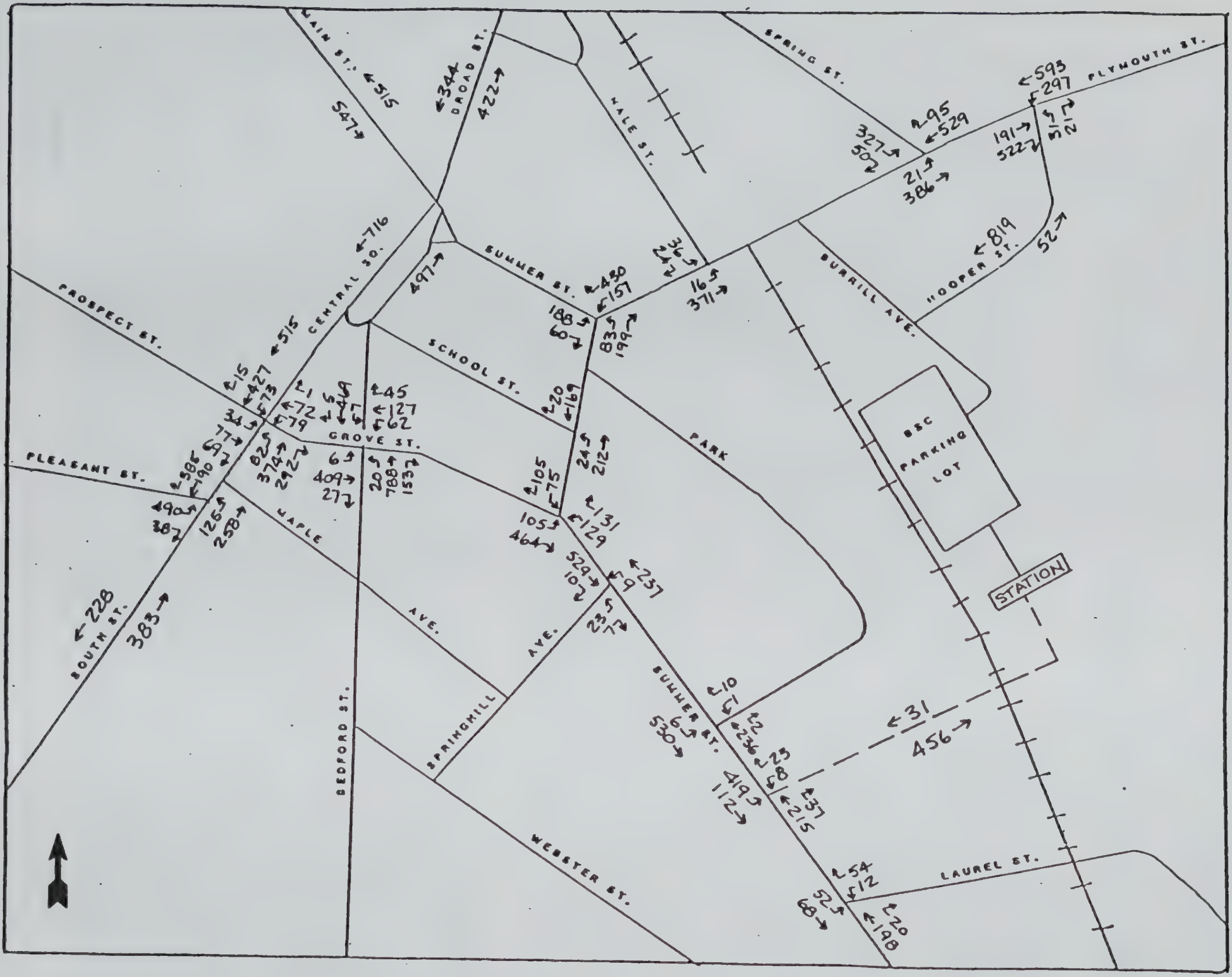


FIG. 11-5a

MIDDLEBOROUGH: Bridgewater Future Traffic with Station— AM Peak Hour

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

Old Colony Railroad
Rehabilitation Project

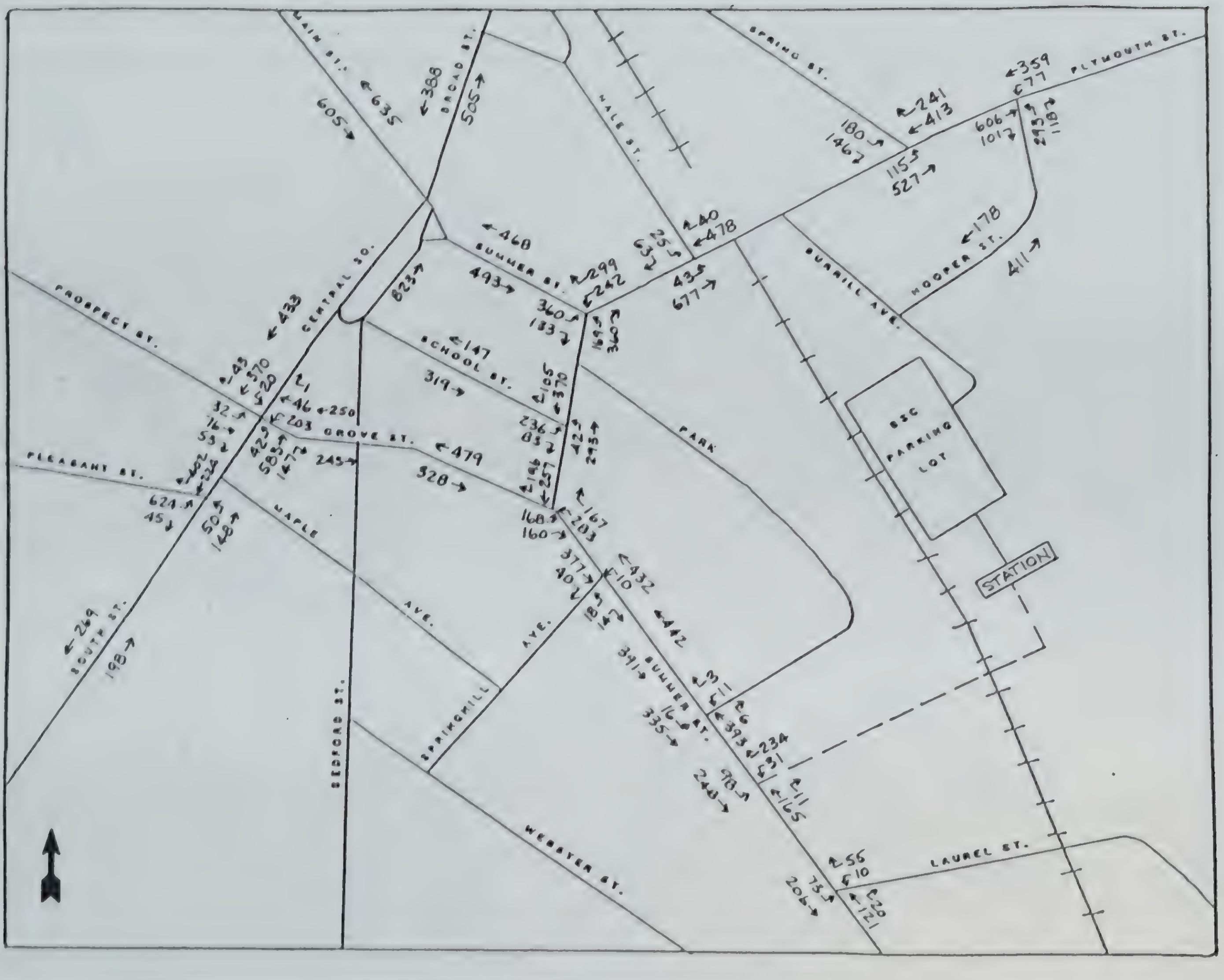


FIG. 11-5b

MIDDLEBOROUGH: Bridgewater Future Traffic, with Station— Pm Peak Hour

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

Old Colony Railroad
Rehabilitation Project

12. Middleborough/Lakeville Station and Line Segment from the Bridgewater Town Line to the Nemasket River

This segment extends from the Bridgewater/Middleborough town line to the Nemasket River. It is the last segment on the Middleborough Line. The proposed station site is in Lakeville just beyond the Middleborough town line. The station site is accessed from Route 105 at a point about a quarter of a mile south of the Interstate Route 495 interchange.

There are no grade crossings along this segment. Consequently, the roadway traffic impacts of the project are associated only with station access.

12a. Streets and Intersections

The principal streets serving the proposed Middleborough/Lakeville Station site are Route 105, Interstate Route 495, Route 79, Route 18, and Route 28.

Route 105, locally known as Main Street, runs between the Middleborough business district to the north and the center of Lakeville to the south. There is a partial cloverleaf interchange providing access to and from Interstate Route 495 southbound and Interstate Route 495 northbound about a quarter of a mile north of the Middleborough/Lakeville town line. Route 105 has two travel lanes in each direction in the interchange area. On the north side of the interchange, Route 105 narrows to a single lane in each direction north of Route 28 (Grove Street), where it enters the residential and commercial area of Middleborough Center. Between the interchange and Route 28, Route 105 has a number of closely-spaced gas stations, fast food restaurants, convenience stores, and other facilities typically associated with highway commercial strips. On the south side of the interchange, Route 105 narrows to a single lane in each direction south of the Route 79 intersection. The area south of the interchange to Route 79 is undeveloped. South of the Route 79 intersection are residential areas and open space associated with the Lakeville Hospital, a facility of the Massachusetts Department of Public Health. Current open space to the east of Route 105 just south of the Route 79 intersection is the proposed site of Riverside Park, an office and light industrial complex. The proposed Middleborough/Lakeville Station will be within the Riverside Park area.

Interstate Route 495 is a fully grade separated expressway facility which forms a ring of approximately a thirty mile radius around metropolitan Boston. Among its many functions, it provides an alternative to Route 3 for traffic between Cape Cod and the metropolitan regional roadway network. In the Middleborough/Lakeville area, Interstate Route 495 has two travel lanes and a breakdown lane in either direction. Proximity to the major part of the regional transportation network is one of the highly desirable attributes of the proposed Middleborough/Lakeville station site. The interchange at Route 105 is an unsignalized partial cloverleaf providing full access in all directions. It necessitates left turn crossing movements at four locations: (1) for entering traffic northbound on Route 105 getting onto Interstate Route 495 southbound, (2) for entering traffic southbound on Route 105 getting onto Route 495 northbound, (3) for exiting traffic from Interstate Route 495 southbound headed for Route 105 northbound, and (4) for exiting traffic from Interstate 495 northbound headed for

Route 105 southbound. The Route 105 interchange is an unusual one in that it involves a three level stack with Route 105 on the bottom, the MBTA rail line above, and Interstate Route 495 on top. There are two closely spaced interchanges about two and a half miles to the west, also in Middleborough, at U.S. Route 44 and Route 18. The nearest interchange to the east is about four and a half miles away at Rock Village in the southern part of Middleborough.

Route 79, locally known as Rhode Island Road, originates in Freetown to the south and passes through Taunton and Lakeville to a terminus at Route 105. Route 79 is a collector type roadway on which the traffic is largely local in nature. The roadway has a single lane in either direction with no shoulders and does not have either a horizontal or vertical alignment appropriate for high speeds. Near Route 18, access has been provided to the currently under development Great Ponds Industrial Park. Alignment improvements of Route 79 associated with this access are also being undertaken. The land use in the station area near its intersection with Route 105 is low density residential. The unsignalized intersection of Route 79 with route 105 is unusual in that it occurs very close, about two hundred and fifty feet, from the southbound exit and entrance ramps at the Interstate Route 495 interchange. When two intersections are very close to each other turning movements by vehicles at one of the intersections can interfere with turning movements at the other. At low traffic volumes, such as presently exist in the area, such interference is insignificant. However, as volumes increase, the potential for interference also increases.

Route 18 runs from Brockton, along with Route 28, to the Middleborough traffic circle where the two numbered routes split. Route 18 runs southerly towards New Bedford as a major arterial through areas of low density mixed use. Route 18 narrows from two lanes in either direction at the interchange area to one lane in either direction with shoulders to the south of the interchange and through its signalized intersection with Route 79. The recently opened Ocean Spray Headquarters complex is located to the west of Route 18. Access to Route 18 will be provided for the currently under development Great Ponds Industrial Park.

Route 28 runs southeasterly from the Middleborough traffic circle towards Wareham. It generally parallels Interstate Route 495 and provides local access from the interstate highway at interchanges at several points. Near the project area, at its signalized intersection with Route 105, Route 28 is a two lane roadway bordered by mixed residential and commercial land uses. A shopping center now under development, to be known as Middleborough Crossing, will have access from Route 28 in the area just to the east of the Route 105 intersection.

12b. Traffic Volumes

Generally, traffic volumes in the area are not high. The report Transportation Plan Special Study, Route 79 and 105, Lakeville/Middleborough (April 1983), by the Southeastern Regional Planning and Economic Development District, reported that all intersections in the area had level of service "A" and that trucks and buses represented a negligible portion of overall traffic. Any expectation of traffic problems discussed in that report resulted from anticipated area growth rather than from current experience. At the time of that report, growth in traffic volumes was anticipated to result from three major proposed developments in the area. These three proposed development sites have now advanced to a more concrete stage and are now known as 1) the Great Ponds Industrial Park in Lakeville at Route 18 and Route 79, 2) the Riverside Park in Lakeville at Route 105, and 3) the Middleborough Crossing shopping center in Middleborough at Route 28. The proposed Middleborough/Lakeville commuter rail station was not contemplated at the time of the report.

Existing traffic volumes were assembled from the Southeastern Regional Planning and Economic Development District Report and from traffic studies related to the three major development projects. Selected new traffic counts were conducted in the area in 1986 and 1987. These counts were annualized and balanced to develop peak hour traffic volumes as a base case for traffic analysis. The resulting estimates of existing traffic volumes are presented in Figure 12-1. Generally, the afternoon peak hour volumes are greater than the morning peak hour volumes. The heaviest turning movement in the area is 341 vehicle per hour in the afternoon turning from the exit ramp of Interstate Route 495 southbound to Route 105 northbound toward Middleborough Center.

12c. Accident Experience

The Southeastern Regional Planning and Economic Development District (SRPEDD) collects and summarizes data on traffic accidents from the Police Departments of its member towns. SRPEDD computer records of Middleborough accidents were consulted to determine accident incidence at intersections near the proposed station site. Recorded accidents for Calendar Year 1986 and January through October 1987 at these locations are summarized in Table 12-1.

In some cases, accidents reported at intersections actually occurred well away from the intersection with the intersection designation used only as a reference point. The high number of accidents occurring along Route 105 in the area of the Route 28 intersection and the Clark Street intersection may be the result of the large number of turn-ins and turn-outs to commercial establishments along this stretch of Route 105.

12d. Future Growth Assumptions

1) Pending Development Projects

At the time of the Southeastern Regional Planning and Economic Development District's report, Transportation Plan Special Study, Route 79 and 105, Lakeville/Middleborough, concern was expressed about major growth in traffic volumes on roadways in the area because of new traffic to be generated by three potential development projects in the immediate area of the Route 105 corridor. The major mitigation measures proposed in the study were 1) increasing the number of approach lanes at the Route 105/Route 28 intersection and 2) reconstruction and widening of Route 79 with a partial relocation of about a quarter mile of that roadway as it approaches Route 105. This relocation would create a new Route 79/Route 105 intersection about 700 feet to the south of the existing intersection. This new intersection location would eliminate interference between the Interstate Route 495 southbound access ramp intersection and the Route 79 intersection and would allow for signalization at both intersections as necessary to react to increasing traffic volumes.

The three projects foreseen by the Southeastern Regional Planning and

Economic Development District, indefinitely formulated at the time of that 1983 report, have all now emerged as more concrete proposals. These three developments projects are 1) the Great Ponds Industrial Park in Lakeville, 2) Riverside Park in Lakeville, and 3) the Middleborough Crossing Shopping Center in Middleborough.

The Great Ponds Industrial Park is a 190 acre warehouse and light industrial park being developed by the Town of Lakeville. The industrial park property is located between Route 18 and Route 79 and is bounded to the north by an active rail line operated by the Commonwealth of Massachusetts, Executive Office of Transportation and Construction. The industrial park is now occupied by the 300,000 square foot Phase 1 of the Talbots Distribution Center which represents only part of a planned facility of over a million square feet of warehouse space. Facilities for Thompson Box Company and the Rix Dunnington Realty Trust are in advanced stages of design. Present access to the site is provided off Route 79 with access to Route 18 to also be provided as part of the final configuration of the industrial park. The construction of the internal roadways is being funded by an Infrastructure Set Aside Component of the Massachusetts Small Cities Program administered by the Executive Office of Communities and Development. Straightening and improvements of about 3,000 feet of Route 79 from Route 18 to the entrance to the industrial park are being funded by a Public Works Economic Development Grant managed by the Massachusetts Department of Public Works.

The traffic analysis of the industrial park has taken place as part of the environmental assessment process for the Route 79 reconstruction. An Environmental Notification Form for the roadway reconstruction was filed on April 29, 1987. A Certificate of the Secretary of Environmental Affairs was issued on June 25, 1987, stating that an Environmental Impact Report was required and assigning EOEA #6586 to the project. A Revised Certificate was issued on August 26, 1987, allowing a portion of the roadway reconstruction to proceed as a necessary safety improvement and reporting an agreement with the Town of Lakeville to not proceed with any construction in the industrial park beyond that for which commitments had already been made until the environmental assessment process was completed. The issues to be addressed in the Environmental Impact Report were limited to traffic impacts. Requirements of the Scope assigned by the Secretary were an existing traffic volume estimate, a 1992 no-build estimate, and a 1992 full-build estimate, and a determination of problem locations, mitigating measures, and mitigation implementation responsibility. A Draft Environmental Impact Report was issued on May 31, 1988, and a Certificate of Adequacy was filed by the Secretary of Environmental Affairs on July 18, 1988. A Final Environmental Impact Statement was issued on February 28, 1989, and is currently under review.

It was estimated in the traffic analysis that 173 of the total 190 acre area of the site was developable and that when fully occupied by warehousing and light industrial uses in 1990, 9,116 trips per day would be generated by the project. It was further estimated that in the morning peak hour there would be 1,355 trips generated and in the afternoon peak hour 2,247 trips generated. It was estimated that 22% of the traffic generated by the project at the peak hours would utilize the Route 79/Route 105 intersection. The analysis does not deal with turning movements at the Interstate Route 495/Route 105 interchange on the assumption that the vast majority of Interstate Route 495 access will take place at the Route 18 interchange.

Riverside Park is a 67 acre office and light industrial park being developed by Lakeville Realty Trust. The property is located between Route 105 and the Nemasket River and is bordered to the north by the Middleborough town line and the Massachusetts Bay Transporation Authority's Old Colony Middleborough Line. A portion of the park will be leased to the Massachusetts Bay Transportation Authority for use as the site of the Middleborough/Lakeville Commuter rail station. The park has the potential to accommodate 700,000 square feet of building area in addition to the station site requirements.

The environmental assessment process for this project was initiated by the filing of an Environmental Notification Form on October 31, 1988. A Draft Record of Decision by the Secretary of Environmental Affairs was issued on December 15, 1988, stating that an Environmental Impact Report was required and assigning EOEA #7423 to the project. The Draft Record of Decision allowed the construction of a 22,000 square foot building in the front portion of the park prior to the completion of the environmental assessment process. The secretary will now determine a scope for the Environmental Impact Report.

Although a definitive traffic analysis has not been prepared by the project proponent, an estimate of traffic generation from the completed development can be made based upon assumptions about its eventual use. Assuming complete use of the site by office buildings and light industrial buildings at some future time, 6,509 trips per day would be generated. It can be further estimated that in the morning peak there would be 1,127 trips generated and in the afternoon peak 941 trips generated. Traffic generated by the project would clearly utilize Route 105 for trips to the south, to the north, and for access to Interstate Route 495. It appears that local areas or possibly Fall River to the southwest would be the only destinations requiring using Route 79.

Middleborough Crossing is a 25 acre retail and office complex being developed by Chilmark Development, Inc. The development property is located to the south of Route 28 with its entrance off Route 28 about half way between Route 105 and the Nemasket River. The project is planned to consist of two main anchor stores with connecting stores and an office building as a satellite. The project will achieve full build out at 140,000 square feet of retail space and 20,000 square feet of office space.

An Environmental Notification Form for the project was filed on May 30, 1986. A Certificate of the Secretary of Environmental Affairs was issued on July 9, 1986, stating that an Environmental Impact Report was required and assigning EOEA #6083 to the project. Requirements of the scope assigned by the Secretary relating to traffic impacts were a 1989 no build traffic volume estimate, a 1989 full build traffic volume estimate, a volume to capacity analysis at intersections, and consideration of adding traffic lights, changing the timing of existing traffic lights, and adding traffic lanes. A Draft Environmental Impact Report was issued in August 1986 and a Certificate of Adequacy was filed by the Secretary of Environmental Affairs on October 17, 1986. However, the Certificate indicated the undesirability of a planned entrace drive on Clark Street East off Route 105 in such close proximity to the Interstate Route 495 northbound access ramps. A Final Environmental Impact Report was issued in November 1986. The entrance on Clark Street East was maintained as an access alternative in the Final

Environmental Impact Report but was eliminated in later stages of project development.

It was estimated in the traffic analysis that when fully occupied in 1989, the retail and office complex would generate 10,250 trips per day. It was further estimated that in the morning peak hour there would be 303 trips generated and in the afternoon peak hour 932 trips generated. This total trip figure was reduced for analysis purposes by 25% of the retail activity generated trips since these were assumed to be "impulse" trips made by vehicles already on the road. It was estimated that 38% of all trips to the site had origins or destinations to the South which would utilize Route 105.

2) Basic Traffic Growth

Traffic in the area for the analysis year of 2000 has been estimated on the basis of existing traffic volumes being expanded proportionately to represent background growth in the project area, that is growth that would take place whether or not the Middleborough/Lakeville Station was built. It has been assumed that base traffic in the vicinity of the proposed station will experience a relatively rapid growth rate of 4 percent per year, uncompounded, to the year 2000. This is a resultant 52 percent increase over existing traffic volumes. The base volumes for the year 2000 are shown in Figure 12-2.

This growth rate of 4 percent is, under most circumstances, sufficient to encompass a relatively high rate of background growth. (The commonly accepted, statewide average annual growth in traffic volume is considerably less at 2.5 percent.) However, it is clear from the review of pending development projects in the area that the Route 105 corridor will be experiencing an extraordinarily high rate of traffic growth within the next five years just as was predicted by the Southeastern Regional Planning and Economic Developemnt District in their 1983 report. Since the location, magnitude, and timing of the traffic impacts of each of the developments arrayed around the Route 105 corridor vary widely, future traffic volume growth in the area represents a complex and dynamic situation. The standard practice, employed here, of applying a uniform growth rate to all traffic movements in the area may be sufficiently descriptive of overall area traffic volume growth, but may obscure key problem areas that may emerge prior to the design year of 2000. Recognizing the possible inadequacy for this area of the standard growth assumptions, we have characterized the year 2000 Base Traffic Volumes as minimum volumes recognizing that problem areas may emerge as the presently programmed projects in the area began to generate traffic.

Level-of-Service (LOS) Analysis was applied to the minimum Base Future Traffic Volumes developed by applying the 4 percent annual growth rate. The results are presented in Table 12-2. The existing Route 79 and Interstate Route 495 northbound and southbound access ramp intersections with Route 105 were treated as independent, unsignalized three way intersections for this Base Case analysis. However, it is recognized that the LOS procedure does not adequately capture the difficulty associated with simultaneous conflicting movements to and from intersections in close juxtaposition like the Route 79/Route 105 intersection and the Interstate Route 495 Southbound Access Ramps/Route 105 intersection.

The Level of Service Analysis for Future Base Case Traffic Volumes shows a continuation and in some cases a marked increase in the difficulty of making left turns out of Route 79 and the Interstate Route 495 access ramps onto Route 105. For the Interstate Route 495 northbound access ramps, the ability to make a left turn in from Route 105 southbound is also severely affected by growing traffic volumes. The signalized intersection at Route 105/Route 28 drops significantly in performance during the afternoon peaks.

12e. Station Traffic

At the Middleborough/Lakeville site, patronage estimates for a terminal station were used as a "highest demand" case for purposes of traffic analysis. Patronage projections for the Middleborough/Lakeville Station are 444 daily parkers and 96 daily drop-offs. The peak-hour estimate resulting from this level of use is 324 arriving vehicles and 58 departing vehicles in the morning peak hour with the reverse moves in the afternoon peak hour.

These volumes and their distribution are shown in Figure 12-3. and are added to base traffic volumes in Figure 12-4. The station generated volumes represent an increase over base volumes of 3 to 39 percent depending on location. Level of Service analysis applied to the resulting totals are presented in Table 12-3.

The most significant change, compared with the base conditions occurs at the Interstate Route 495 southbound off-ramp during the PM Peak Hour because of large volumes of station generated traffic turning left onto the SB on-ramp. This left-turn degenerates from LOS "A" under No-Build conditions to LOS "E" under Build conditions. Left-turn queues will develop on Route 105 NB at this ramp entrance blocking the Route 79 intersection for traffic turning left from Route 79 onto Route 105 in the NB direction.

All left turns out of the three unsignalized intersections along Route 105 will also operate at either LOS "E" or LOS "F" in the AM and PM Peak Hours with long delays.

At the Route 105 intersection with Route 28, high background traffic growth will result in LOS "F" during PM Peak Hours before the addition of any traffic generated by the Middleborough/Lakeville Station. Currently, this intersection operates with two approach lanes in each direction, which is adequate to satisfy current and anticipated AM Peak Hour demand but which will experience increasing congestion and failure at high PM volumes. Station-generated traffic adds relatively little volume to this location since the bulk of the patronage of this regional station would arrive by way of the Interstate Route 495 interchange to the south of the intersection. Improved PM operations at Route 105/Route 28 will eventually require adding capacity through widening of two or more of the approaches to two through lanes with an exclusive left-turn lane.

12f. Mitigation Measures

To address delays and potential conflicts caused by station generated traffic as well as the long standing concern about the proximity of the Route 79/Route 105 intersection and the Interstate Route 495 Southbound Access Ramps/Route 105 intersection, several strategies were investigated.

Relocation of the Route 79 intersection to a location southward along Route 105 has been regarded as desirable by SRPEDD since their special study report was issued in 1983 prior to any plan for a commuter rail station in the area. Such a relocation would eliminate the potential conflicts between Route 79 traffic and traffic entering and leaving Interstate Route 495 Southbound. This major project would represent a benefit to all traffic in the area irrespective of its origin. Clearly the minimum base traffic growth alone without the addition of the Middleborough/Lakeville Station generated traffic would be sufficient to make this relocation an advisable improvement. With numerous interested parties involved, each contributing to the problem to some extent and each benefiting from the solution to some extent, an equitable division of responsibility among the parties is necessary to make a major project like the Route 79 relocation viable.

As a smaller scale but less satisfactory alternative to the Route 79 relocation, the installation of traffic signals at the Route 79 and Interstate Route 495 Southbound Access Ramps intersection with Route 105 can be provided for the existing intersection configuration. Signals at these two locations would be operated by a single controller in multiple phases including an advance green for northbound left-turn moves from Route 79 and from the Interstate Route 495 southbound off ramps onto Route 105. This signal configuration will operate satisfactorily in the AM Peak Hour. PM Peak Hour LOS values will be at the D or E level, because of the high volumes of conflicting traffic to be processed. This signalization may be regarded as a useful measure, but eventual Route 79 relocation remains the preferred solution.

In addition to traffic signals at the Route 105/Route 79 intersection and the Route 105/Interstate 495 SB access ramps, the intersection of the ramps on the NB side of I-495 are also proposed for traffic signal control. Signalization here will allow operation of left turns from the off-ramp at adequate levels of service. Likewise, a traffic signal at the proposed station entrance, semi-actuated or set to flashing yellow during off-peak periods, will provide gaps for exiting station traffic.

Table 12-4 illustrates anticipated PM Peak Hour Levels of Service at individual intersections assuming the proposed traffic signal installations to be in place. In addition, an arterial analysis of Route 105 between the proposed station entrance and Route 28 in Middleborough was undertaken using the computerized procedures of the 1985 Highway Capacity Manual. Each of the four proposed signalized intersections in this section of Route 105, namely at the station entrance, at the Interstate Route 495 Southbound access ramps, at the Interstate Route 495 Northbound access ramps, and at Route 28, was analyzed separately using future PM Peak Hour traffic volumes which included background growth and station-generated volumes.

An approximation of operations at the jointly controlled Route 105/Route 79 and Route 105/Interstate Route 495 Southbound Access Ramps intersections was included since the actual configuration cannot be represented in the standard Highway Capacity Manual signalized intersection format. Under the present configuration, four arterial segments are defined by the four intersections, spaced roughly one thousand feet apart along Route 105.

In both directions, this section of Route 105 operates at LOS C or better in all segments except for the segment ending at the I-495 SB access ramps, (which experience LOS D in the westbound direction), and that ending at Route 28, (which experience LOS F in the eastbound direction). The SB off-ramp intersection operation would clearly be improved by relocating Route 79. If Route 79 is ultimately relocated, it will create a new signalized intersection with Route 105 located to the south of its existing location. The improved spacing and resultant decrease in interference between the two intersections would result in improved operations.

The primary impact of the Middleborough/Lakeville station will be on Route 105 in the area between the I-495 NB access ramps and the station entrance where the mitigation measures are proposed. Station-related traffic additions to Route 105 intersections north of the I-495 NB ramps will be minimal in comparison to the assumed background traffic growth. In summary, the proposed mitigation measures are as follows:

- Widening Route 105 at the proposed station entrance to provide a WB left-turn storage lane, and an EB right turn deceleration lane (see DEIS Chapter IX, Figure IX-C10).

- Installation of traffic signals at the intersections of:

    - Route 105 and Route 79;
    - Route 105 and the I-495 Southbound Access Ramps;
    - Route 105 and I-495 Northbound Access Ramps; and
    - Route 105 and the station entrance.

- Coordination with SRPEDD, The Town of Lakeville, the Town of Middleborough, District 7 of the Massachusetts Department of Public Works, and other project proponents in the area to develop a long term plan for the relocation of Route 79 and assign responsibilities.

TABLE 12-1

Middleborough Traffic Accident Incidence

Intersection	Number of Recorded Accidents 1986	Number of Recorded Accidents Jan-Oct 1987
Main St. (Rt.105) corridor:		
S.Main/E.Grove/W.Grove (Rt.28)	33	32
S.Main/Clark St.	9	12
S.Main/I-495 ramps	5	4
S.Main/Rhode Island Rd. (Rt.79)	6	2

Source: SRPEDD Records

TABLE 12-2

Level of Service Analysis
Middleborough/Lakeville Station Area Intersections
No Build Case

	EXISTING TRAFFIC (1987)				FUTURE BASE TRAFFIC (2000)			
	AM PEAK HOUR		PM PEAK HOUR		AM PEAK HOUR		PM PEAK HOUR	
	Left Turn In	Left Turn Out	Left Turn In	Left Turn Out	Left Turn In	Left Turn Out	Left Turn In	Left Turn Out
Unsignalized Intersections								
Route 79 at Route 105	A	C	A	D	A	E	A	F
I-495 SB ramps at Route 105	A	D	A	F	A	F	A	F
I-495 NB ramps at Route 105	B	E	B	E	D	F	D	F
Signalized Intersection								
Route 105/Route 28		B		C		B		F

TABLE 12-3

Level of Service Analysis
Middleborough/Lakeville Station Area Intersections
Build Case

	FUTURE BASE TRAFFIC (2000)				FUTURE BASE TRAFFIC PLUS STATION GENERATED TRAFFIC (2000)			
	AM PEAK HOUR		PM PEAK HOUR		AM PEAK HOUR		PM PEAK HOUR	
	Left Turn In	Left Turn Out	Left Turn In	Left Turn Out	Left Turn In	Left Turn Out	Left Turn In	Left Turn Out
Unsignalized Intersections								
Route 79 at Route 105	A	E	A	F	B	F	C	F
I-495 SB ramps at Route 105	A	F	A	F	B	F	E	F
I-495 NB ramps at Route 105	D	F	D	F	D	F	D	F
Station Driveway	--	--	--	--	C	E	A	F
Signalized Intersection								
Route 105/Route 28		B		F		B		F

TABLE 12-4

Level of Service Analysis
Middleborough/Lakeville Station Area Intersections
Signalization Provided

	Future Peak Hour LOS Base Traffic Plus Station Generated Traffic	
	AM	PM
Route 105/Route 79/ SB off-ramp	A	D
Route 105/NB off-ramp	B	B
Route 105/Station driveway	B	B

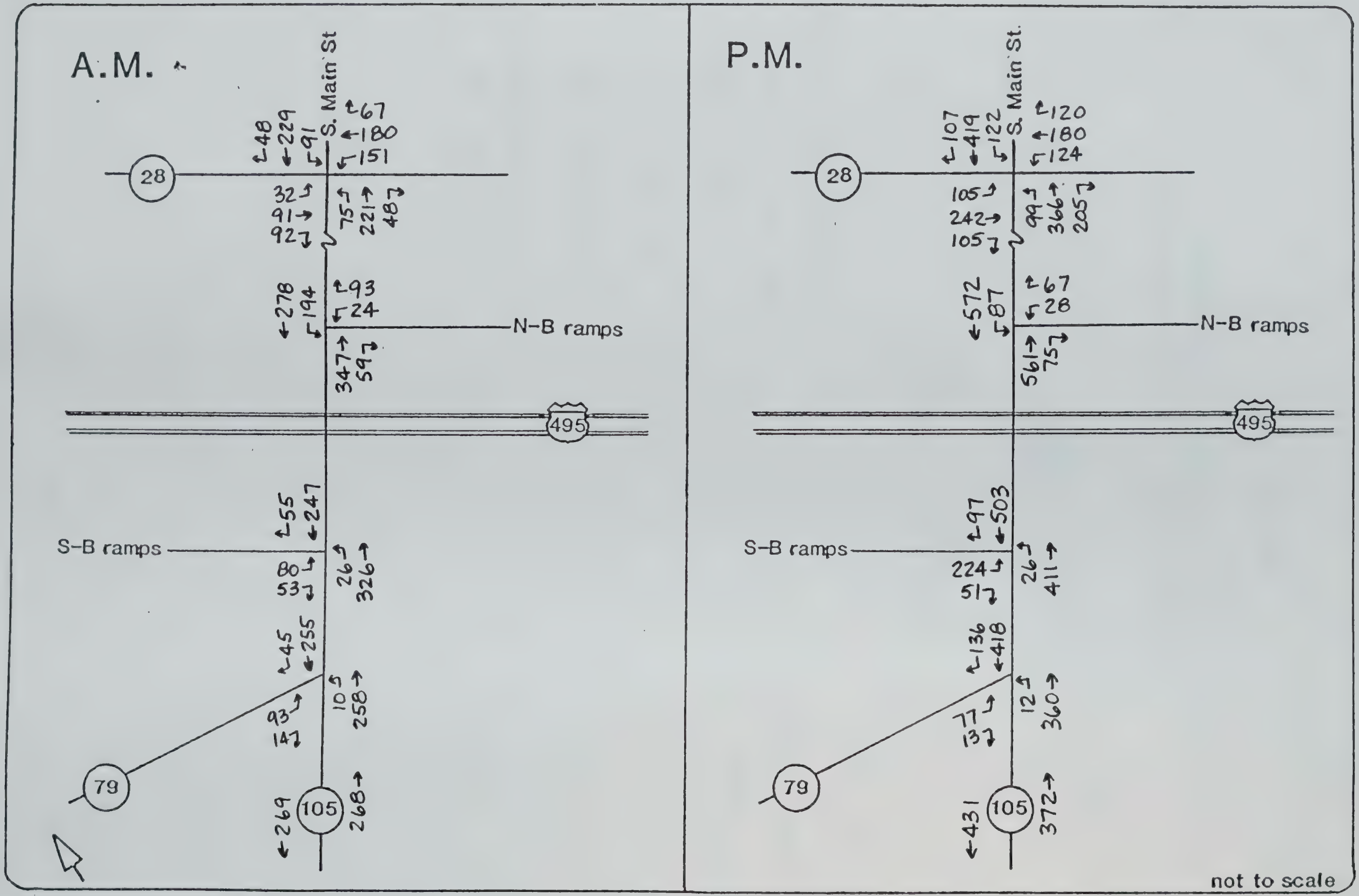


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FIG. 12-1
MIDDLEBOROUGH: MIDDLEBOROUGH/LAKEVILLE
EXISTING TRAFFIC

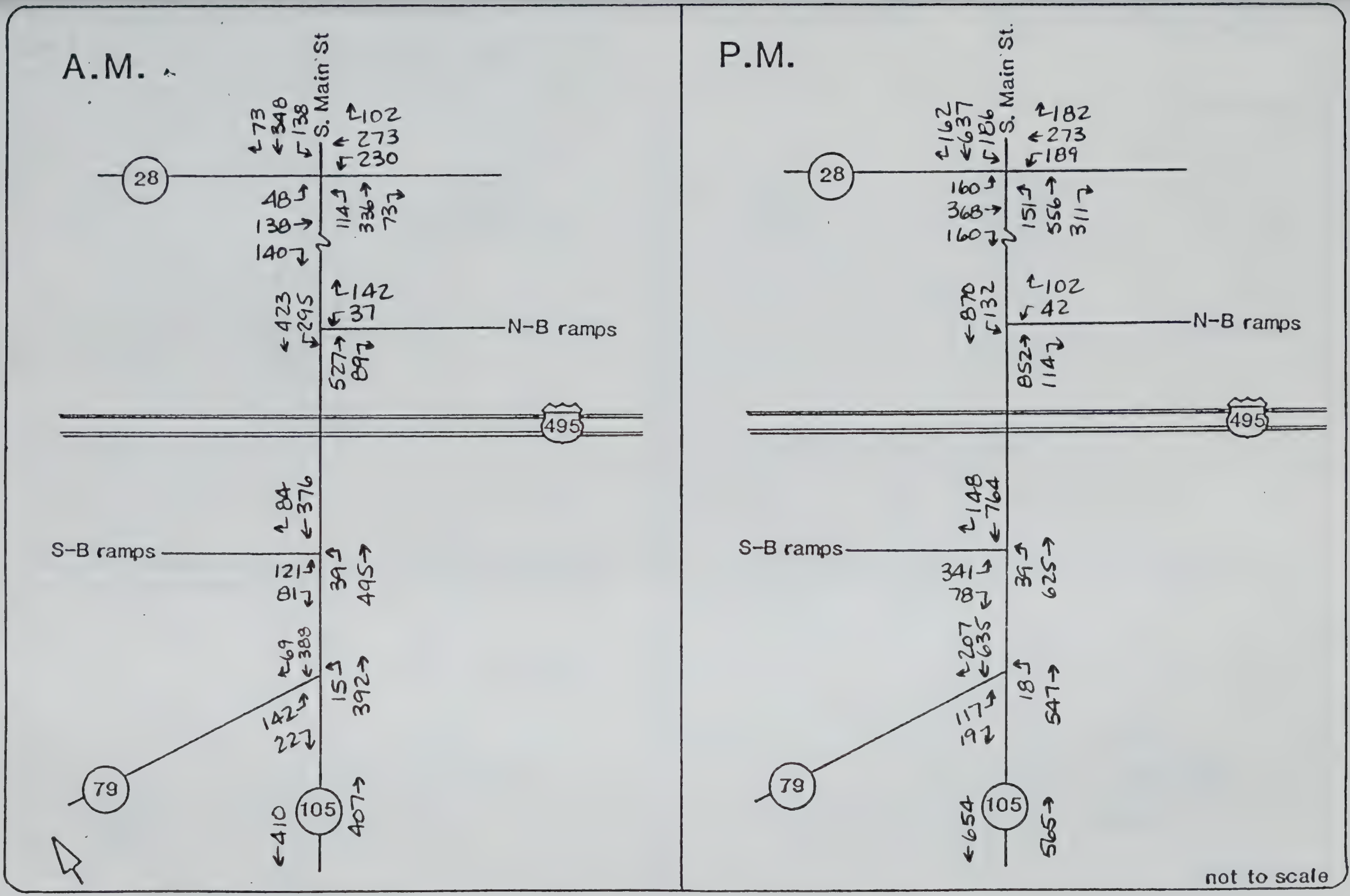

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FIG 12-2
MIDDLEBOROUGH: MIDDLEBOROUGH/LAKEVILLE
YEAR 2000 BASE TRAFFIC

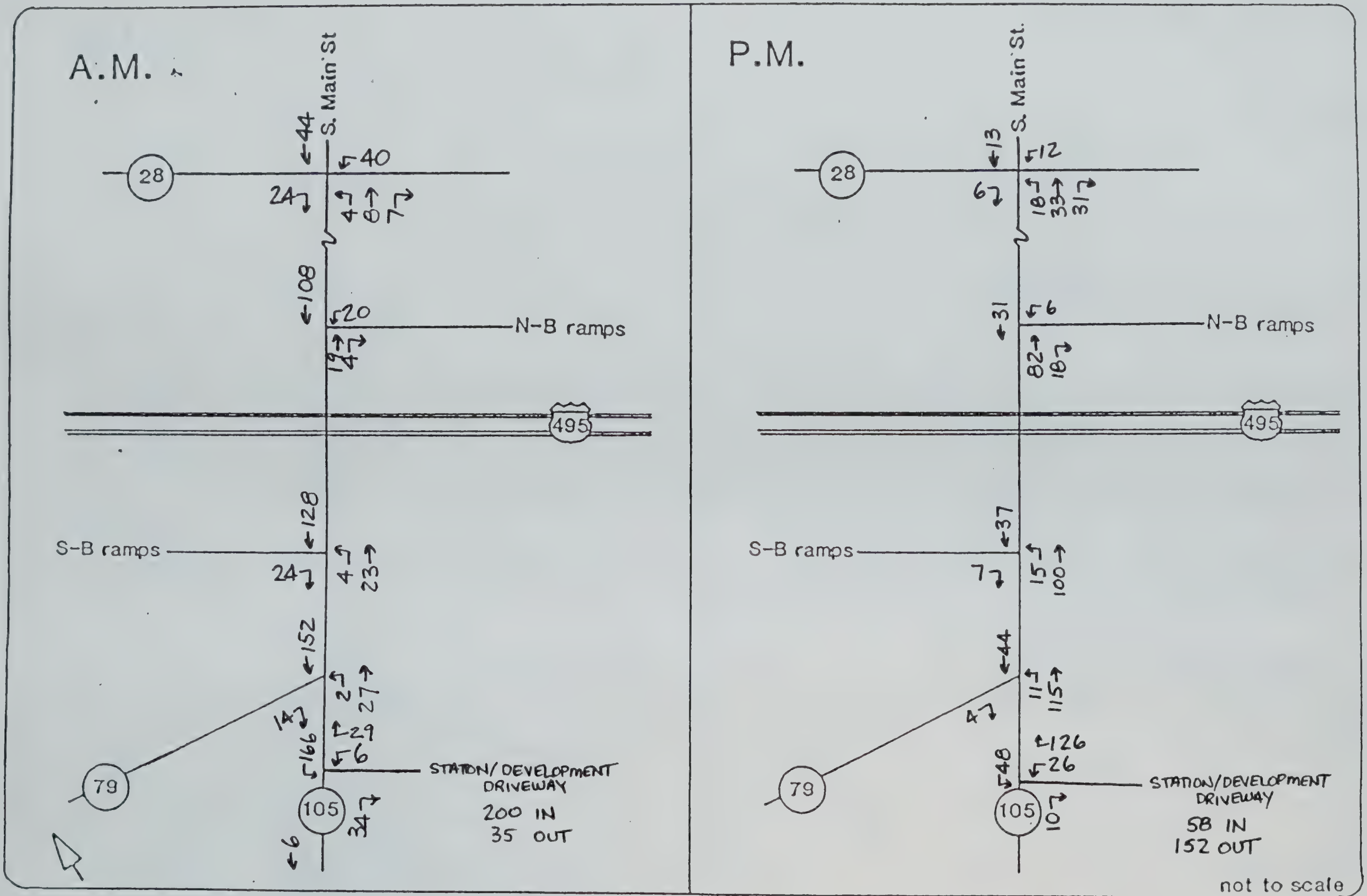

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FIG. 12-3
MIDDLEBOROUGH: Middleborough/Lakeville
DEVELOPMENT TRAFFIC — OTHER STATION/SITE LOTS
(150 ksf lt. industry, 50 ksf office)

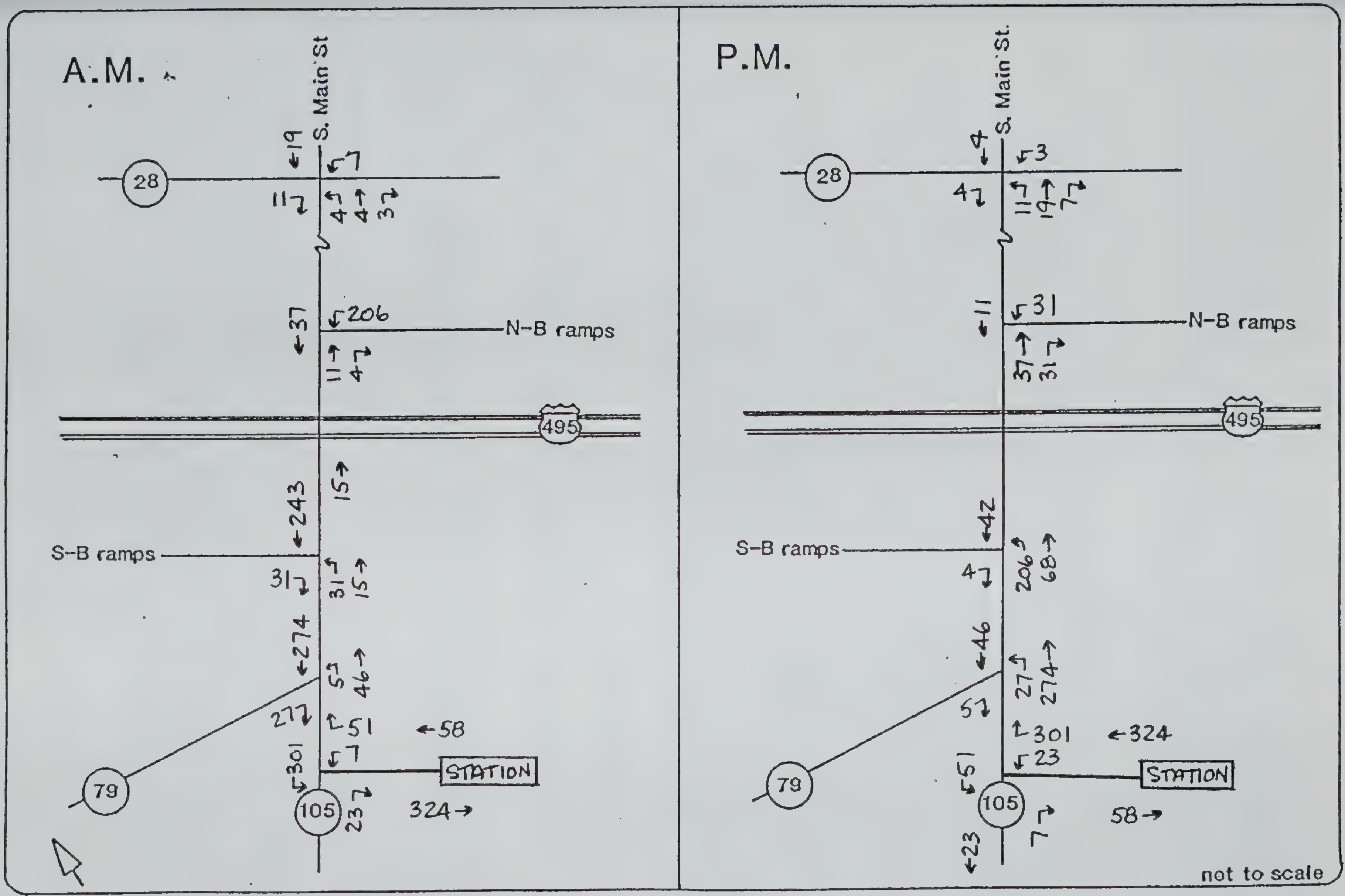

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FIG. 12-4
MIDDLEBOROUGH: Station Traffic

MIDDLEBOROUGH/LAKEVILLE

13. Line Segment from South Braintree Junction to Braintree-Weymouth Line on Plymouth Line

This segment itself does not contain a station location, although it is located within range of the Braintree Station described under Section 5. Consequently, traffic impacts here are associated primarily with the two grade crossings at Ivory Street and West Street.

13a. Streets and Intersections

Ivory Street is a high-quality 4-lane street which connects Union Street with Plain Street. The street, formerly known as Ivory Lane, was extended and reconstructed as part of the MBTA's Red Line extension to South Braintree. Its primary functions are to provide access to the MBTA's Braintree parking facility and to provide a by-pass around the South Braintree business district. At present there are relatively few curb cuts on Ivory Street. Only a few large industrial firms have secondary access onto the street. Ivory Street's intersections with Union, Pearl and Plain Streets are signalized, and intersections are generally designed with adequate capacity to handle foreseeable traffic growth.

West Street is a 2-lane roadway serving primarily residential uses. It intersects with Columbian and Grove Streets just inside the Braintree-Weymouth town line. Tricon, Inc. is constructing a 90,000 sq. ft. building devoted to research/development uses, with a primary access driveway located about 400 feet east of this intersection. As part of this proposal, the existing 3-legged intersection would be redesigned as a fully-channelized intersection, with free right turns on the West and Columbian Street approaches and left turns brought into the intersection at a 90 degree angle.

13b. Existing Traffic

Existing traffic data in this area were compiled from counts performed by several firms in connection with 3 proposed projects located close to the grade crossings:

- The Tricon project described above.
- The SEMASS proposed Waste-to-Energy Facility on Ivory Street.
- The proposed Pearl Street shopping center, between Ivory and Washington Streets.

Existing vehicle arrival rates at both grade crossings, based on these counts, are as illustrated in Table 13-1.

In order to ascertain impacts of railroad operations at these two grade crossings, future approach volumes were estimated by adding the anticipated developments to Future Base (Year 2000) volumes, and estimating average arrival rates during train passbys. Here, as elsewhere, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. The proposed schedule calls for half-hour commuter-train headways on the Plymouth Line during peak hours, with off-peak service at approximately 2-hour intervals. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

Table 13-2 summarizes the results of the queuing analysis at both grade crossings. "Peak" queuing rates were determined by estimating the 95th percentile arrival rate given the average rates as cited in Table 13-2 and assuming Poisson arrivals (a conservative assumption which overestimates the variance in arrivals [and therefore the maximum likely queues], since peak-hour conditions are not random).

The nearest intersections potentially affected by traffic backups from grade crossings, in both directions, are listed in Table 13-3.

The conclusions of this analysis are as follows:

- Ivory Street--queues will not back up to nearest intersections on either grade crossing approach during either peak hour (although driveways close to the crossing will be blocked).
- West Street--(assuming Maximum-Build Tricon) queues from the track will back up beyond Summer Street (on the east side of the track) during the AM Peak Hour, and will extend into the intersection of Grove/Columbian/West Streets during the PM Peak Hour. At the latter intersection, about 40 percent of the total approach volume can be expected to be vehicles turning left from Grove into West; so that eastbound Columbian Street may be blocked by queued traffic waiting to make this left turn. Both these locations will need traffic improvements if the volume increases associated with the Tricon Maximum-Build scenario occurs.

TABLE 13-1

Existing and Future Base Case Vehicle Arrival Rates, Braintree Segment Intersections

	Year 1987	Year 2000*
Ivory Street		
--NB		
AM Peak Hour	935	1057
PM Peak Hour	444	502
--SB		
AM Peak Hour	293	331
PM Peak Hour	741	837
West Street		
--EB		
AM Peak Hour	250	283
PM Peak Hour	434	490
--WB		
AM Peak Hour	558	630
PM Peak Hour	456	515

*NOTE: Represents 1987 volumes increased by 1 percent per year uncompounded; does not include Tricon, SEMASS, or shopping center developments explicitly. (SEMASS and shopping center are included explicitly in "Future Build" volumes of Table 13-2. At West Street, analysis was done with and without Tricon Maximum-Build).

TABLE 13-2

Queuing Analysis
Braintree Segment Grade Crossings

	Peak Hour Approach Volume	Avg. 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	"Peak" Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Ivory St.					
--NB					
AM Peak Hour	1106	28	34	390*	59*
PM Peak Hour	575	14	19	220*	
--SB					
AM Peak Hour	405	10	15	170*	50*
PM Peak Hour	911	23	29	340*	57*
2. West St.--Tricon Maximum-Build added					
--EB					
AM Peak Hour	351	8	13	290	53
PM Peak Hour	990	25	31	680	70
--WB					
AM Peak Hour	1181	30	36	790	75
PM Peak Hour	594	15	20	440	60

*assumes 2 lanes in each direction, with lane occupancy factor of 1.05.

TABLE 13-3

Intersections Near Grade Crossings--Braintree Segment

Ivory Street		
--south of g/c:	Plain St.	420′
--north of g/c:	(no intersections within 1000′)	
West Street		
--east-of g/c:	Summer St.	610′
--west of g/c:	Grove St.	470′

14. South Weymouth Station and Line Segment from Braintree-Weymouth Line to Weymouth-Abington Line

This report describes traffic impacts of the segment from the Braintree-Weymouth Line to the Weymouth-Abington Line, on the Plymouth Branch. A station is proposed to be located on the site of the present PS Personal Storage facility, on Route 18, with access to be provided from Trotter Road. Two public grade crossings are located on this segment, at Randolph Street and at Hollis/Pond/Derby Streets. Traffic impacts here include general rail station-related impacts as well as impacts resulting from grade crossing operations.

14a. Existing Streets

The proposed station would have access directly from Route 18 via Trotter Road, a minor street which presently provides access to a Coast Guard buoy repair facility and Gallagher's Lumber, in addition to serving as emergency access for the South Weymouth Naval Air Station.

Route 18 is the principal north-south arterial roadway serving this part of the Old Colony Region. Route 18 has one travel lane plus shoulder for most of its length, with 2-lane approaches at major intersections. The posted speed limit on Route 18 is 40-45 mph, and drivers tend to maintain this speed or higher when traffic allows. Therefore, it is difficult for vehicles exiting from abutting land uses or minor streets/driveways to find safe gaps in Route 18 traffic.

The first major intersection north of the Abington Town Line is at Pond Street, designated Route 58 south of Route 18. The Route 58 approach is presently stop-sign-controlled. Motorists making the through move from Route 58 to Pond Street NB, and reverse, experience difficulty because of the high volumes and high speeds on Route 18, as well as the angle of the intersection.

In addition, a small shopping center, a drive-in bank, and a paint store with its parking lot, have curb cuts or access points close to this intersection. The shopping center access has very little curbing definition or channelization; and the bank driveway is used as a cut-through by traffic heading south on Route 18 or on Route 58.

North of Route 58 on Route 18, there are two signalized intersections: the main driveway of the South Weymouth Naval Air Station, and Pond/Pleasant Street.

The new Main Gate to the Naval Air Station opens directly onto Route 18 north of its intersection with Pond St/Route 58. All Station traffic now uses this gate for access and egress, relocated from the previous entrance via White and Central Streets. The Naval Air Station estimates that: 1) their peak traffic hours occur on weekends, when reservists are in residence at the station. During the week, most traffic is associated with non-resident workforce and commercial vehicles and 2) their weekday peak-hour traffic comes from north, south, and west of the Station, so that a high proportion of generated traffic was already using Route 18 to reach the Naval Air Station even before the entrance was relocated.

The new gate location includes wide, separate lanes for storing left- and right-turning vehicles, along with left- and right-turn lanes on Route 18 itself. In addition, traffic signals have been installed at the gate location. No problems are anticipated to result from operation of the new gate.

The Route 18/Pond/Pleasant Street intersection is also controlled with traffic signals, and features 2-lane approaches from all 4 directions. It carries moderately heavy peak hour volumes, since Pleasant Street/Ralph Talbot Street, together with Columbian Street, are the key east-west streets serving Weymouth south of Route 3.

Pond Street is a bow-shaped street which meets Route 18 at both ends; it is essentially a residential street serving a collector function for the surrounding neighborhoods. Pond Street beyond its intersections with Route 18 has one travel lane in each direction. Its intersection with Hollis and Derby Streets occurs about 1500 feet south of the Route 18/Pond/Pleasant Street intersection. Most of the streets intersecting Pond Street are exclusively residential, several of them dead-ending in the vicinity of Weymouth Great Pond. They therefore generate only minor volumes of local traffic.

14b. Existing Volumes

Traffic counts were performed at several locations in the vicinity of the proposed rail station and along Route 18. Supplementary information was made available by the Naval Air Station. The results of counts are displayed as Existing Traffic Volumes on Figure 14-1

The highest area volumes are to be found on Route 18 itself, with around 1000 northbound vehicles in the AM Peak Hour. Traffic trying to turn left onto Route 18 from an unsignalized side street has a very difficult time identifying acceptable gaps. The directional split on Route 18 is fairly high--65-70 percent northbound in the AM Peak Hour.

At Route 58, relatively high volumes turning right onto Route 18 in the morning merge with the also-high northbound volume already on Route 18. In the PM Peak Hour, the corresponding left-turn from Route 18 SB to Route 58 is also a fairly heavy move (around 300 vehicles).

14c. Accident Experience

Town of Weymouth Police Records were consulted to determine accident experience at intersections of concern near the proposed commuter rail station. Recorded accidents for Calendar Year 1986 and January-June 1987 at these locations are summarized in Table 14-1.

None of these totals appears unusually high as an absolute number. For each location, an accident rate was calculated per million vehicles entering the intersection annually. A peak hour factor of 0.10 was assumed, and daily totals were multiplied by 300 to estimate annual volumes. The rates thus calculated were compared with the statewide average rate for signalized intersections (1.89) and unsignalized intersections (0.95)[1].

As shown in Table 14-1, only the intersection of Route 18 and Route 58/Pond Street exceeds the statewide average.

14d. Future Growth Assumptions

No development projects were identified as proposed or pending approvals in the immediate vicinity of the proposed station site, although growth in the towns south of Weymouth is expected to add future traffic to Route 18.

The most noteworthy local project is the expansion of the South Shore Hospital. This addition will consist of an additional 60-bed patient pavilion, with access via the existing hospital driveways and Fogg Road. Construction is expected to begin shortly, with completion and opening anticipated in 1990.

For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 1 percent per year, were computed and are presented in Figure 14-2.

Given these growth levels, future Levels of Service at several area intersections were calculated, and are presented in Table 14-2. For signalized locations, the LOS grade characterizes operation of the intersection as a whole. For unsignalized intersections, each critical movement has a separately-calculated LOS grade.

As Table 14-2 indicates, the Route 18/Route 58/Pond Street intersection will operate poorly under unsignalized conditions, and, in fact, probably warrants signalization at present.

14e. Station Traffic

The proposed location for a South Weymouth commuter rail station is at the site of the current PS Personal Storage Facility, just north of Route 58 on Route 18. Station access would be provided from Trotter Road.

Patronage forecasts by mode of station access were originally produced for two rail alternatives, as described in Section B (Methodology), but assuming a station location farther north in Weymouth; viz., at the intersection of Hollis and Pond Streets. These patronage estimates were slightly revised given the assumption of the new station: a high proportion of walk-in Weymouth traffic associated with the former location is now assumed to drive, or be dropped off, at the Route 18 location, and a slightly greater percentage of vehicle arrivals is assumed to come from towns south of the station.

For purposes of the traffic analysis, forecasts for Alternative 3B, Middleborough and Plymouth Lines only, were used to determine peak hour vehicle attractions to the station. This resulted in total daily vehicle arrival estimates of 352 parking vehicles, with 293 drop-offs.

---

[1] CTPS Technical Report 54a, Draft Route 9 Corridor Planning Study: Short-Range Element, January 1986.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 211 parking vehicles arriving AM, departing PM, and 176 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 14-3.

Route 18, as a major north-south arterial route, is expected to be a principal beneficiary of regional traffic reductions associated with the Old Colony project. In order to account for the project's traffic reductions, as well as its localized additions, through traffic on Route 18 in the peak direction only was assumed reduced 20 percent by the project. This is consistent with the reductions forecast for Route 18 by the regionwide demand forecasting process, and is appropriate for the Weymouth segment of Route 18, which is very close to Route 3.

The sum of the revised Base Traffic case (assuming reduced peak-direction Route 18 volumes) and station traffic yields an estimate of Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 14-4.

In order to accommodate a railroad station at this location on Route 18, several modifications would be required. These include widening of Route 18 in the vicinity of Trotter Road, to accommodate an additional northbound through/right-turn, and 2 southbound left-turn lanes. In addition, channelization and curbing would be undertaken at Route 58/Pond Street, and coordinated traffic signals would be installed at the Route 58/Pond Street and Trotter Road intersections with Route 18.

Level of Service calculations were performed at each of these intersections, and at Route 18/Pond/Pleasant Street, assuming Year 2000 volumes with the station.

14f. Grade Crossings

The crossings at Randolph Street, and through the intersection of Hollis and Pond Streets, will be equipped with full gate controls. The maximum period of gate closure is assumed to be 90 seconds at both crossings. The proposed rail schedule calls for half-hour commuter-train headways on the Plymouth Line during peak hours, with a maximum of 3 train passbys per peak traffic hour anticipated.

Analysis was performed to estimate average and maximum length of queues, and average delay time per stopped vehicle, at these two grade crossings. The results of this analysis are presented in Table 14-3.

The average delay per stopped vehicle is estimated as half the stopped time, plus the start-up time for the median vehicle, with start-up time assumed to be 2 seconds per queued vehicle. For the 4 approaches at the Hollis/Pond/Derby intersection, the average stopped delay is:

	Average Stopped Delay per Vehicle (seconds)	
	AM Peak Hour	PM Peak Hour
- Pond St. NB	57	54
- Pond St. SB	53	58
- Hollis St. EB	50	56
- Derby St. WB	47	48

Only on the northbound approach of Pond Street at Hollis does the anticipated maximum vehicle queue approach or extend beyond the nearest intersection. This intersection is with Hilldale Road, a residential cul-de-sac, which may occasionally be blocked for up to 90 seconds in the AM Peak Hour when northbound vehicle arrivals on Pond Street are unusually heavy.

Given the scheduling assumptions and estimated maximum passby time, about 7-8 percent of peak hour traffic on Pond, Hollis and Derby Streets can expect to be stopped for a train passby.

At Randolph Street, peak hour traffic volumes were estimated in lieu of counts, based on the use of the street and its residential character. Here, too, the maximum gate closure interval is estimated at 90 seconds. There is no danger of queues building up as far as Pond Street, given the assumptions of this analysis. Average stopped delay is estimated as follows:

	Avg. Stopped Delay per Vehicle, sec.	
	AM Peak Hour	PM Peak Hour
- Randolph St. EB	47	48
- Randolph St. WB	48	47

14g. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of fully- protected gate crossing controls at Hollis/Pond/Derby Streets and Randolph Street.
- Street improvements--widening of Route 18 to permit 2 northbound lanes and 3 southbound lanes (including 2 left-turn lanes); channelization and curbing of Trotter Road and the Route 58 and Route 18 approaches in this area.
- Traffic signalization--installation of coordinated traffic signals at the Route 18/Route 58/Pond Street and Route 18/Trotter Road intersections.

Conceptual plans for the proposed street and signalization improvements are shown in the DEIS, Chapter IX, Figures IX-C11a, IX-C11b, IX-C11c and IX-C11d.

TABLE 14-1

Accident Incidence from Weymouth Police Records

Intersection/Street	Numbers of Recorded Accidents 1986	1987*	Estimated Rate per Million Entering Vehicles
Hollis/Pond/Derby St.	2	0	0.45
Route 18/Pond/Pleasant St.	10	4	1.10
Route 18/Derby St.	9	2	1.20
Route 18/Pond (Rt. 58)	8	3	0.97
Total Townwide	1495	711	

*through June

TABLE 14-2

Level of Service Analysis
South Weymouth Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service: Year 2000 Traffic without South Weymouth Station AM	PM	with South Weymouth Station AM	PM
Route 18/Pond/Pleasant	YES	C	D	C	D
Route 18/Trotter Road	NO	E-C#	E-B#	--	--
	YES*	--	--	C	B
Route 18/Route 58/ Pond	NO	E-F**	E-F**	--	--
	YES*	--	--	B	B

*proposed mitigation measure (NOTE: Levels of Service reported here are for individual intersections; but the Trotter Road and Route 58/Pond Street intersections should be interconnected).

** all moves out of minor streets.

# left turns out of Trotter/left turns into Trotter.

TABLE 14-3

Queuing Analysis: South Weymouth Grade Crossings

	Peak Hr. Approach Volume (veh.)	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival	Peak Queue Length, (ft.)	Dist.to Nearest Inters'n (ft.)
1. Hollis/Pond St.					
Pond St. NB approach					
AM Peak Hour	482	12	17	375	330
PM Peak Hour	342	9	14	310	330
Pond St. SB approach					
AM Peak Hour	301	8	13	285	830
PM Peak Hour	509	13	18	395	830
Hollis St. EB approach					
AM Peak Hour	180	5	10	220	>1750
PM Peak Hour	446	11	16	350	>1750
Derby St. WB approach					
AM Peak Hour	83	2	7	155	830
PM Peak Hour	130	3	8	175	830
2. Randolph St.					
EB approach					
AM Peak Hour	(151)	4	9	200	>1600
PM Peak Hour	(194)	5	10	220	>1600
WB approach					
AM Peak Hour	(194)	5	10	220	770
PM Peak Hour	(151)	4	9	200	770

() = estimated volume

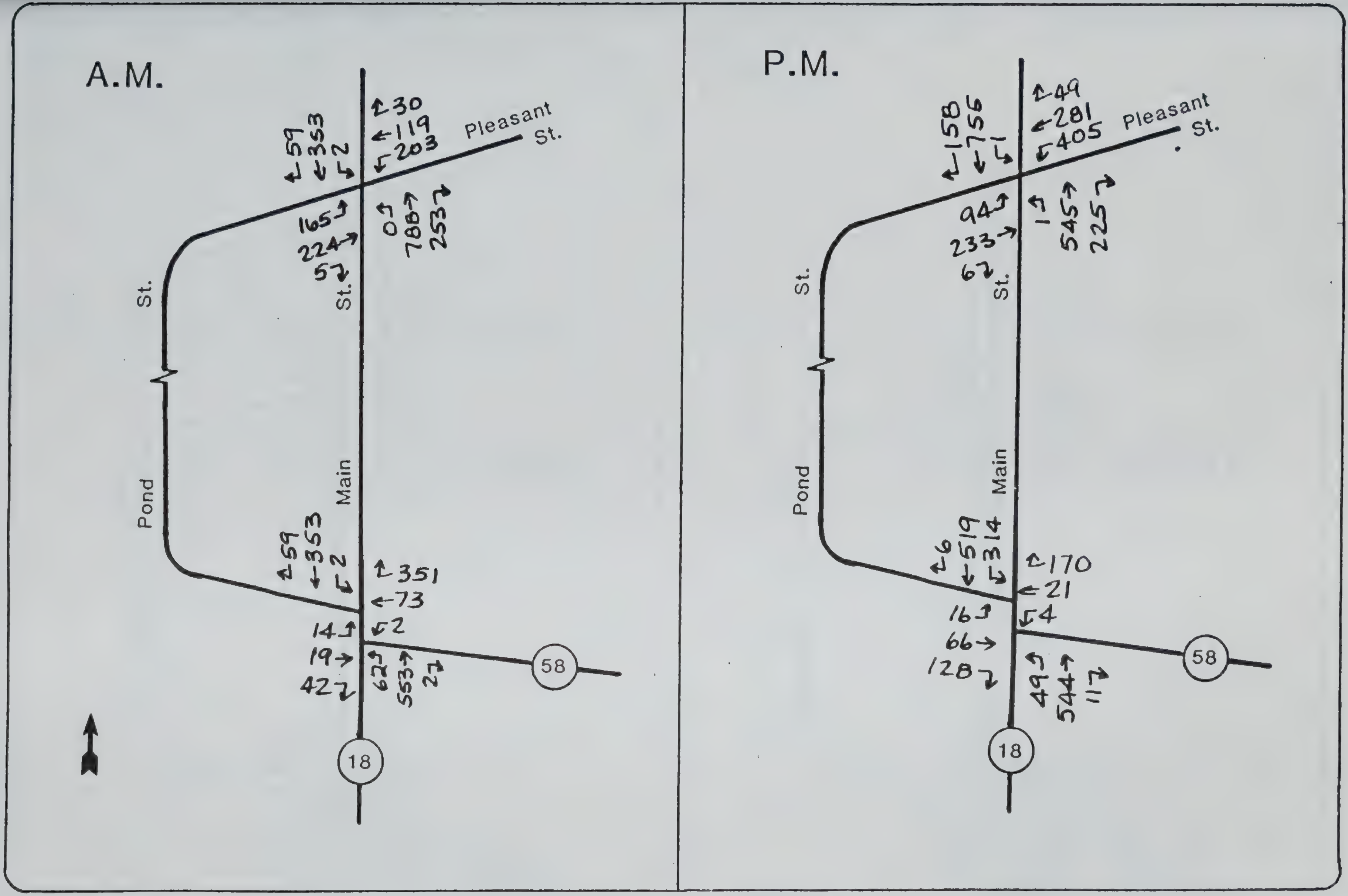

Figure 14-1
PLYMOUTH: SOUTH WEYMOUTH
EXISTING TRAFFIC

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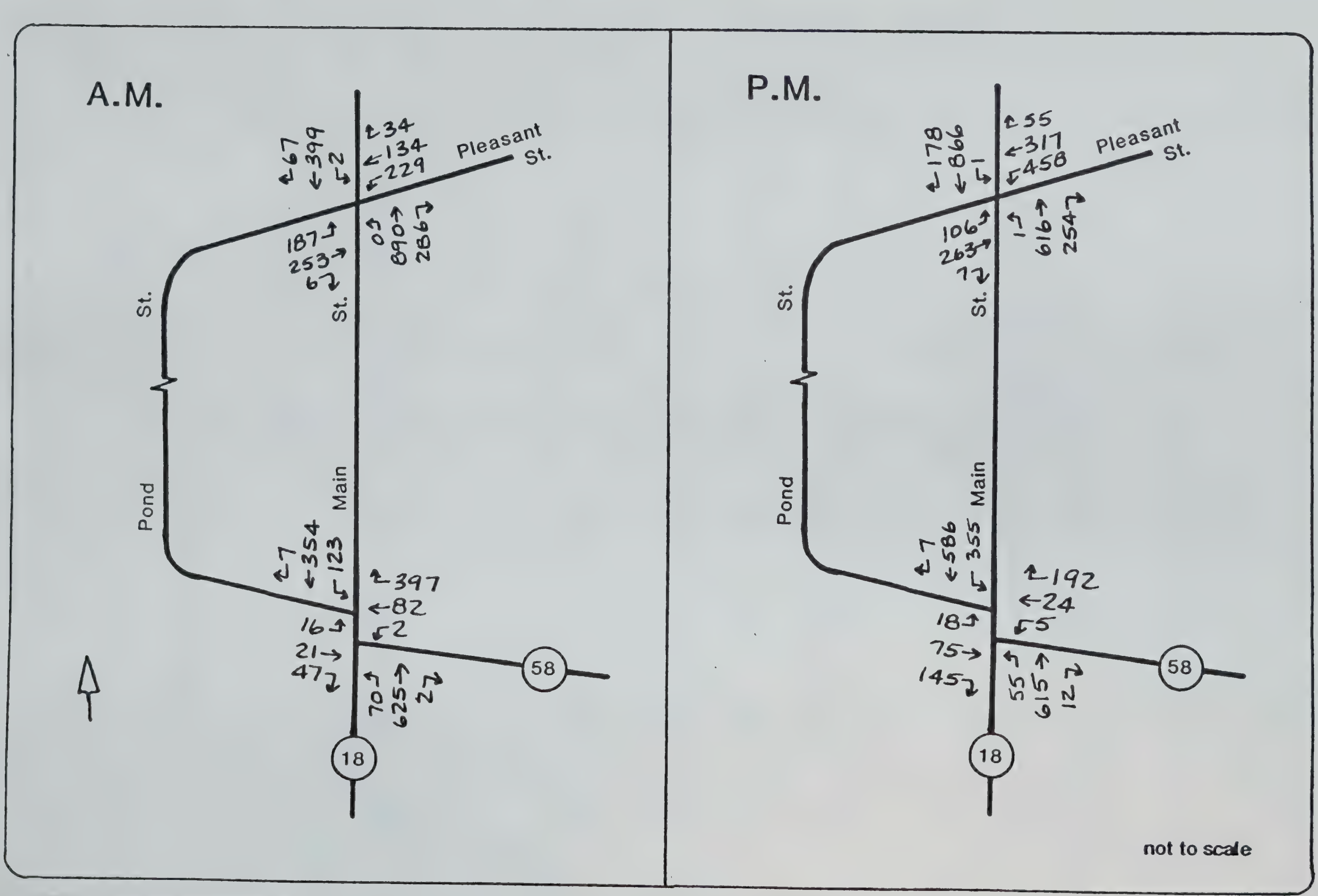

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Figure 14-2
PLYMOUTH: SOUTH WEYMOUTH
YEAR 2000 BASE TRAFFIC

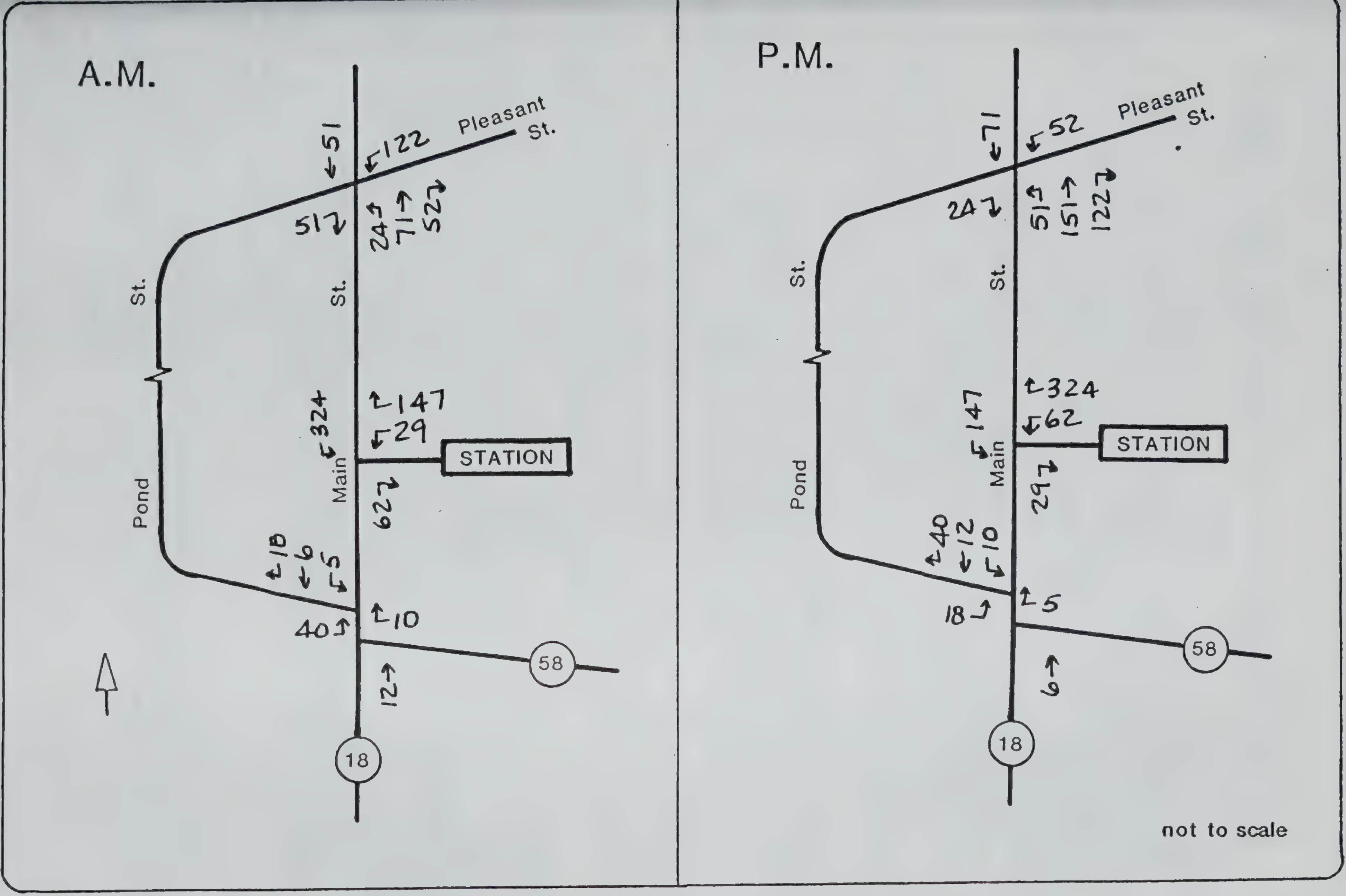

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Figure 14-3

PLYMOUTH: South Weymouth
Station Traffic

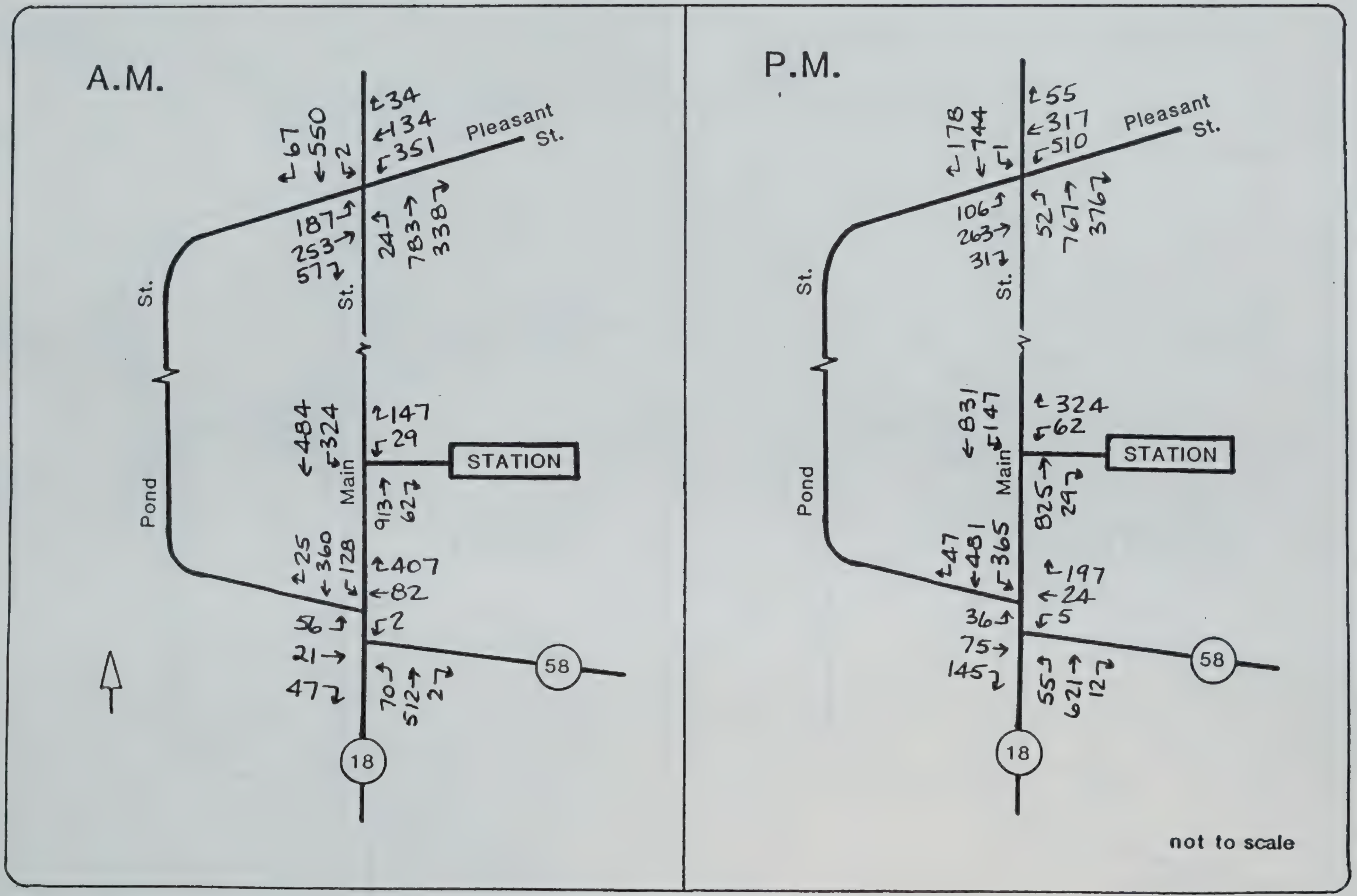

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Figure 14-4
PLYMOUTH: SOUTH WEYMOUTH
FUTURE TRAFFIC, WITH STATION

15. Abington Station and Line Segment from Weymouth-Abington Line to Abington-Whitman Line

This section includes the segment from the Weymouth- Abington town line to the Abington-Whitman line on the Plymouth Branch. It includes a proposed station location between Birch Street and Plymouth Street. In addition, there are 7 grade crossings in this section: at Pine, Wales, North, Birch, Plymouth, Centre and Summer Streets. An active railroad spur crosses Birch Street 200 feet east of the Plymouth Line track.

15a. Streets and Intersections

The streets providing access to the proposed station site are Plymouth and Birch Streets. Birch Street is a 2-lane east-west street, approximately 22 feet wide, which travels as one lane in each direction. Birch Street provides connections for station-bound traffic from east of Abington, via an intersection with North Street (Route 139), approximately 1,400 feet east of Montoe Street.

West of Monroe, the intersection of Birch Street with Plymouth (Route 58) and Brighton Streets is an unsignalized 5-way intersection. The right-of-way at this location generally belongs to Plymouth Street, but is ambiguous among the minor streets. Several schools are located in its immediate vicinity, and a school crossing guard directs traffic at this location on school mornings.

Plymouth Street where it crosses the railroad south of the station site is a 2-lane roadway. It functions as one of the major north-south streets in Abington, serving Hanson, Halifax, Plympton and Carver to the south and terminating at Route 18 in Weymouth to the north.

The station parking lot abuts Monroe Street, although no access is provided from that street. Monroe Street is a short street which connects Birch Street with Plymouth. Residences occupy the east side of Monroe Street, as well as the part of the west side close to Plymouth Street. The proposed station site is on two parcels of land, one occupied by a recently constructed lumber warehouse, and the other by a freight yard used occasionally by the Bay Colony railroad.

North Street (Route 139) is the primary east-west roadway in this area, serving the small North Abington business district located in the vicinity of the track. On-street parking and sidewalks are provided on North Street in this area. Traffic tends to move slowly in this area, because of parking movements and pedestrians.

The original North Abington station building is located north of North Street, on Railroad Street. It was originally considered for possible reuse as a railroad station, but was dismissed because it was converted to a restaurant, and because parking in the vicinity of the old site is extremely limited.

Route 58 and nearby Route 18 are the principal north-south streets in this part of the study area. Both streets travel as 1 lane in each direction, widening out at approaches to signalized intersections. Route 58 is called Plymouth Street south of the 5-way Birch Street intersection, and Adams Street north of Birch. Plymouth Street is anticipated to provide primary station access from the south, with vehicles turning onto the station at the proposed access driveway on Plymouth Street just east of the grade crossing.

15b. Existing Volumes

AM and PM peak period turning movement counts were performed by the consultants at several locations near the former and proposed station sites. Traffic count data were assembled, annualized and balanced to produce Existing Traffic Volumes, as illustrated on Figure 15-1.

As shown, traffic on Birch Street between Plymouth and North Avenue is not strongly directional: directional splits vary between 54 and 63 percent eastbound in the AM Peak Hour, and 57-59 percent westbound in the PM Peak Hour. On the other hand, traffic on Plymouth Street (Route 58) has a much stronger directional orientation: 79 percent of total volume is northbound in the AM Peak Hour, 69 percent southbound in the PM Peak Hour, suggesting its importance as a north-south commuter route. Peak Hour Factors on the major streets of teh area range from 0.90 to 0.96, suggesting that flows are fairly constant on these streets, rather than sharply peaking for brief periods.

15c. Accident Experience

Traffic accident data for 1986 was obtained from the Abington Police Department. Only accident incidence was recorded; information on types of accidents was not obtained. Table 15-1 summarizes accident incidence at critical locations in 1986.

An estimate was made of accident exposure using peak- hour turning movement counts factored to approximate total annual vehicles at each intersection. Peak hour volumes were assumed to be 10 percent of ADT, with total annual volumes estimated at 300 times ADT. The resulting rates (per million annual entering vehicles) are also presented in Table 15-1. While they are only gross approximations, it is likely that the 5-leg intersection of Birch/Plymouth/Brighton Streets experiences higher-than-average accident rates, compared with other locations. This is most likely attributable to unorthodox geometrics and ambiguity regarding right-of-way at this complex location.

15d. Future Traffic Growth

To account for future growth in locally-generated and through traffic, a growth factor of 1.2 percent per year uncompounded, or 15.6 percent overall, was applied to 1986 traffic volumes. The resulting Base Year 2000 traffic volumes are as shown on Figure 15-2.

Level of Service Analysis was applied to the intersections of Birch/Adams/Brighton Street,and Birch/North Ave./John Street, assuming existing geometric designs and traffic controls. For the two unsignalized intersections, LOS results were calculated separately for each critical move for Year 2000 AM and PM Peak Hour traffic with and without the proposed station. At the intersection of Birch/Adams-Plymouth/Brighton, no critical movement had a lower LOS than "D" with the station without any improvements. At the intersection of Birch/North/John, the minor left-turn from Birch onto North became LOS "E" in the AM Peak Hour, as the result of added station traffic. The same movement in the PM Peak Hour was LOS "E" with or without the station.

15e. Station Traffic

Patronage forecasts for an Abington station, by mode of access, were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for Alternative 3b, Middleborough and Plymouth Lanes only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 323 total daily parkers, with 196 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 193 parking vehicles arriving AM, departing PM, and 118 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, is as shown on Figure 15-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Plymouth, Birch, North, or other streets.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 15-4, represent increases above Base 2000 volumes of 12-50 percent, depending on location. Level-of-Service results for each intersection under future volume conditions are shown in Table 15-2.

15f. Grade Crossings

Of the 7 grade crossings in this segment, 5 are on fairly busy streets and 2 (Pine Street and Wales Street) are on minor streets which serve mainly to provide local access to residents. Traffic volumes were available for 4 of the 7: at Wales, North, Birch and Plymouth Streets. The Pine Street crossing was assumed to carry traffic volumes on the same scale or less than the Wales Street crossing; while the North, Birch and Plymouth Street crossings were used as models for Centre and Summer Streets.

With Old Colony commuter service through this built-up area, a commuter train passby is assumed to require a maximum gate closure of 90 seconds for crossings where the trains are not stopped, and 2 minutes for the Birch Street crossing when the train is stopped at the station. The proposed schedule calls for half-hour commuter train headways on the Plymouth Line during peak hours, with freight train use restricted to off-peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

The queueing analysis is summarized in Table 15-3.

Birch Street under the current circulation scheme (Figure 15-4) is the only location where it will be necessary for the train to be stopped across a street while it is in the station. This is because there is insufficient room for long trains to clear both the Birch and Plymouth Street crossings. Based on volumes at both locations, it is judged less disruptive to block Birch than to block Plymouth (Route 58) for 2 minutes at a time.

The distances from each crossing to the nearest intersections are shown in Table 15-4. The locations that will be blocked by the "peak-condition" queue are as follows:

1) Wales Street--Railroad Street will be blocked by short queues on Wales Street, but very little traffic is affected. Queues on Wales will not extend back to Route 58.

2) North Street--Spruce Street will be blocked briefly by grade crossing queues in both peak hours. In the EB direction, queues will extend beyond Railroad Street in both peak hours. In the PM Peak Hour, the maximum queue will back up beyond Brighton Street. Both Railroad and Brighton are minor streets with low volumes, controlled by stop signs. Blockage of these streets is not considered a serious impact. The distance to Plymouth Street (Route 58) at this location is over 700 feet, so that grade crossing queues will not extend this far.

3) Birch Street maximum likely grade crossing queue in the WB direction will block Monroe Street briefly during the PM Peak Hour, but not under average conditions. This does not represent a major impact. EB queues will not extend back to Plymouth Street under maximum conditions.

4) Plymouth Street--residential traffic exiting from Norton Street will be blocked by Plymouth Street SB traffic during most grade crossing closures. As with other minor streets in the area, the number of vehicles affected by such blockage will be small, and the impact not considered to be significant. The grade crossing is not within queuing range of either Birch or Monroe Street. The principal impact will be on vehicles entering and leaving the station arriving just east of the grade crossing which would be prevented from entering or leaving while NB queues exist.

5) Pine Street--is not within the range of nearby intersections.

6) Centre Street--no potential intersection blockage expected in the WB direction; Park Street will be blocked by grade crossing queues. West of track, Park Street will be blocked by queues in both peak hours.

7) Summer Street--although no likely intersection blockage is expected in either direction, Progress Street may be blocked under extremely unusual conditions.

15g. Mitigation Measures

The following traffic measures are recommended:

1) Grade crossing controls. These include installation of full signalized gate controls at all grade crossings in this segment. The Plymouth Street crossing signalization would include a signal to the south of the station driveway which would be timed to permit vehicles existing from the station to make left turns southbound into Plymouth Street. While the gates are down, this will permit vehicles making left turns into the station to be unimpeded by NB Plymouth traffic prior to each gate closing.

2) Traffic signalization. This includes installation of traffic signals at intersection of Plymouth/Birch/Adams Street.

3) Street improvements. These include:

  - Possible one-way NB operation of Brighton Street, lane striping;

  - left-turn lane designation on Birch Street at station entrance, and Birch Street at Monroe;

  - right- and left-turn lanes on Plymouth Street at station entrance; and

  - channelization improvements at North and Birch Streets.

Conceptual plans for the proposed improvements are included in the DEIS, Chapter IX, Figures IX-C12 through IX-C14.

TABLE 15-1

Accident incidence at Abington Intersections, 1986

Intersection	Numbers of Accidents	Rate per Million Entering Vehicles
Birch/Plymouth St.	8	
Brighton/Plymouth St.	3	4.0
North/Birch/John St.	4	0.88
Monroe/Birch St.	1	
Monroe/Pattison St.	1	
TOTAL	17	

TABLE 15-2

Level of Service Analysis
Abington Station Area Intersections

Intersection	Signal-ized?	Level of Service: Year 2000 Traffic without Abington station AM	PM	with Abington station AM	PM
Plymouth/Birch/ Adams/Brighton	NO	D*	D*	D*	D*
	**	--	--	B	B
Birch/North/ John	NO	D*	E*	E*	E*

*left turns from minor onto major street (Birch to Adams; Birch to North Ave. WB)
**if simple 2-phase signal installed at this location

TABLE 15-3

Queuing Analysis
Abington Station/Line Segment Grade Crossings

	Peak Hour Approach Volume	Avg. 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	"Peak" Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Wales St.					
--EB					
AM Peak Hour	67	2	5	110	47
PM Peak Hour	116	3	7	155	48
--WB					
AM Peak Hour	91	2+	5+	110+	47+
PM Peak Hour	118	3	7	155	48
2. North St.					
--EB					
AM Peak Hour	362	9	14	310	54
PM Peak Hour	732	18+	23+	505+	63+
--WB					
AM Peak Hour	562	14	19	420	59
PM Peak Hour	499	13	18	400	58
3. Birch St. [1]					
--EB					
AM Peak Hour	218	7+*	12+	265+	67+*
PM Peak Hour	162	6*	11	240	66*
--WB					
AM Peak Hour	151	5*	9	200	65*
PM Peak Hour	257	9*	14	310	69*
4. Plymouth St.					
--NB					
AM Peak Hour	584	15	20	440	60
PM Peak Hour	230	6	11	240	51
--SB					
AM Peak Hour	157	4	8	175	49
PM Peak Hour	509	13	18	400	58

---

[1] assuming 2-minute closure while train stopped in station (all other closures assumed to be 90-second passbys).

TABLE 15-4

Distance to Nearest Intersection
Abington Grade Crossings

	East of track	West of track
Pine Street	360′ to Glen	360′ to Adams
Wales Street	470′ to Spruce	30′ to Railroad
North Street	305′ to Spruce	30′ to Railroad 360′ to Brighton
Birch Street	250′ to Monroe	330′ to Plymouth
Plymouth Street	(NB) 640′to Monroe	(SB) 20′ to Norton 750′ to Birch
Centre Street	700′ to Plymouth	85′ to Park
Summer Street	(none nearby)	580′ to Progress

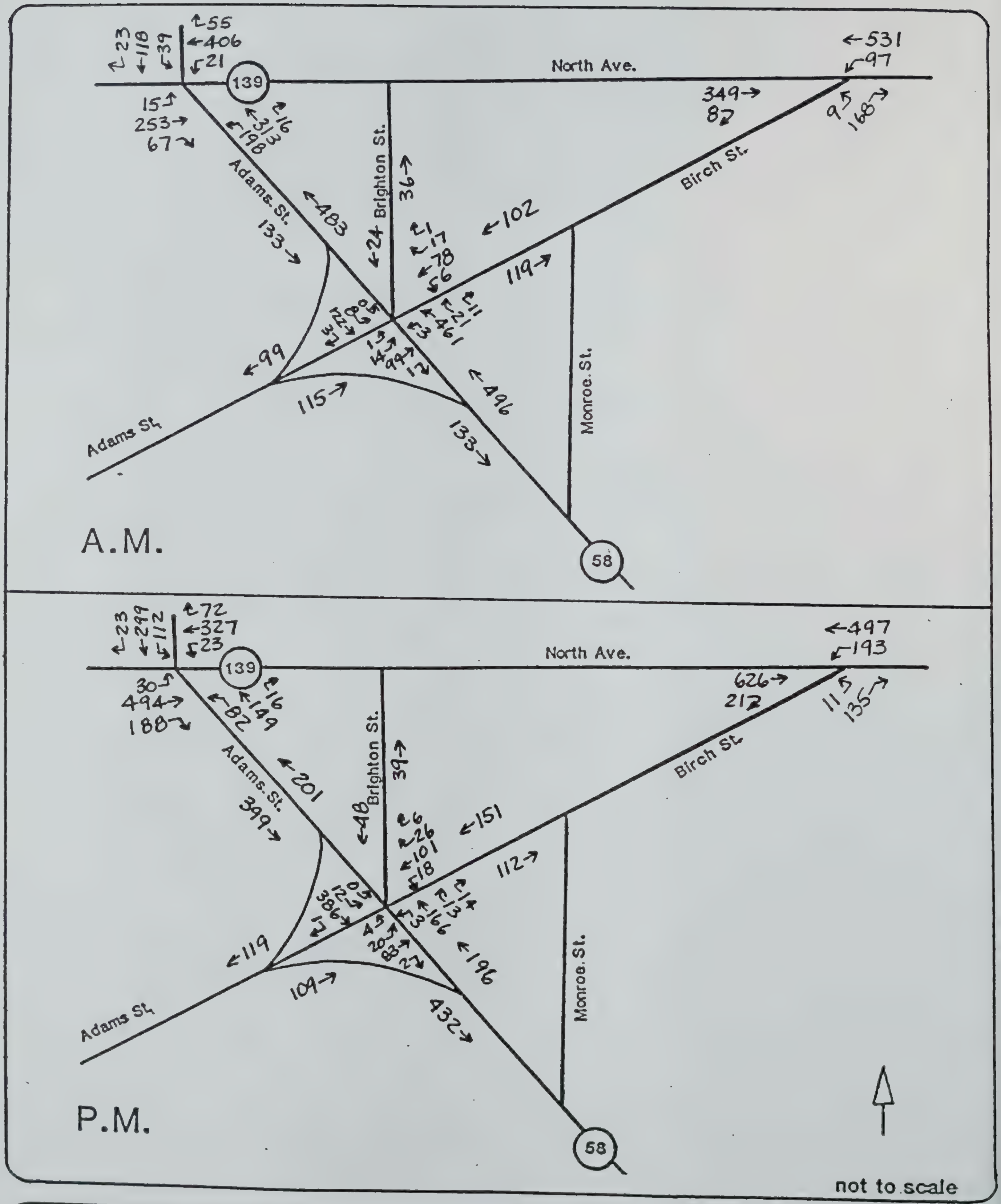

FIG. 15-1
PLYMOUTH: Abington
EXISTING TRAFFIC

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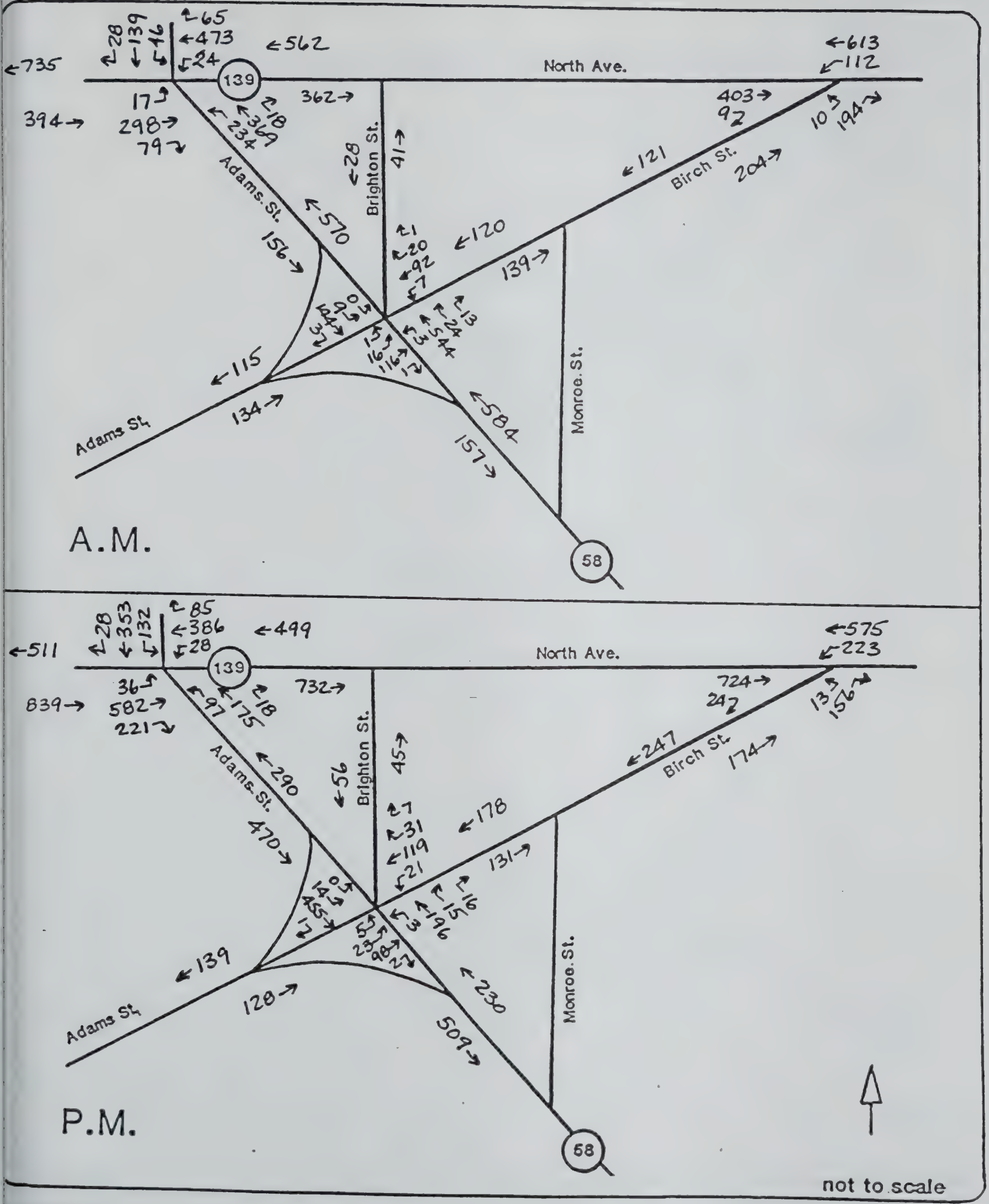

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FIG. 15-2
PLYMOUTH: Abington
YEAR 2000 BASE TRAFFIC

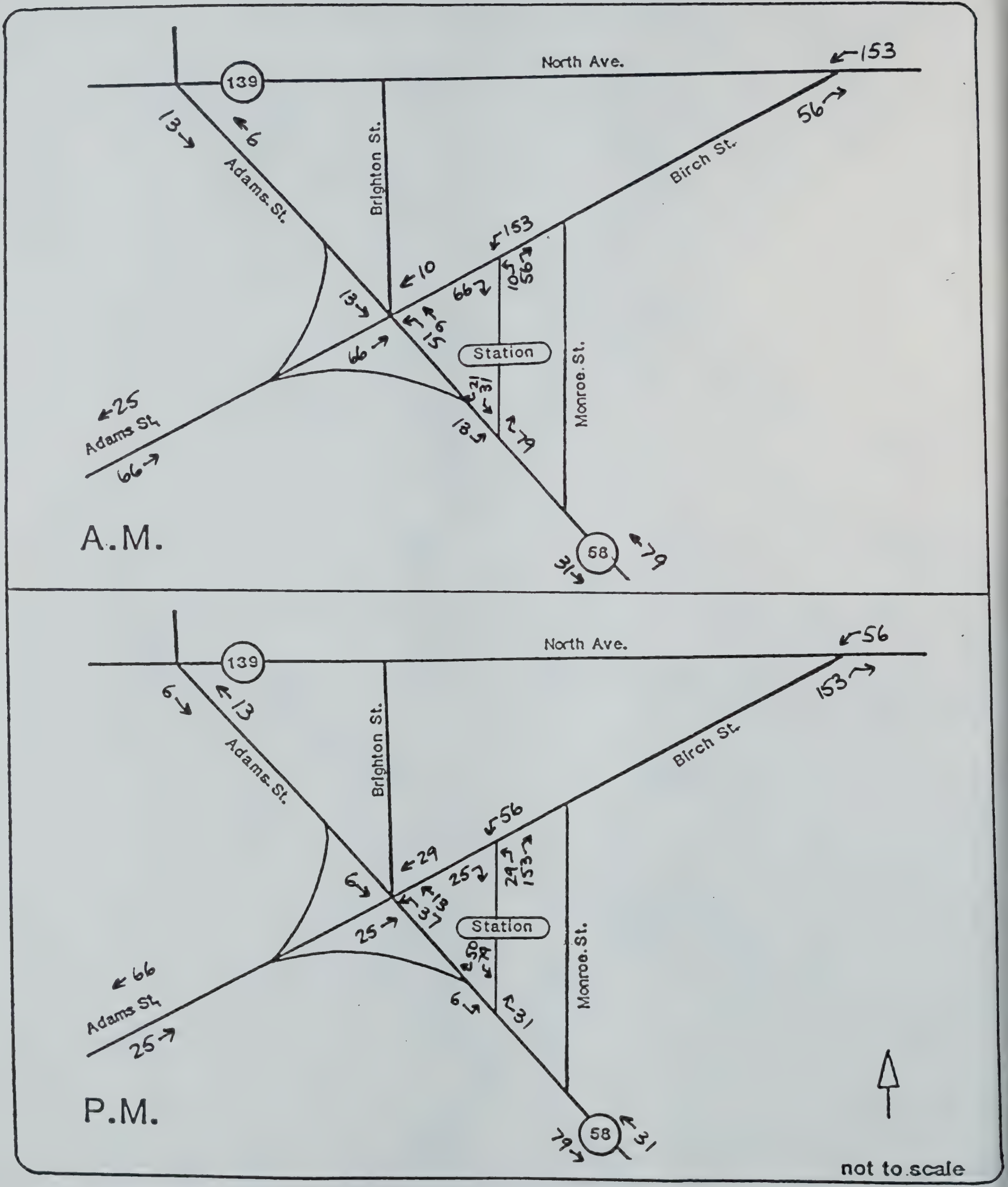

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FIG. 15-3
PLYMOUTH: Abington
Station Traffic

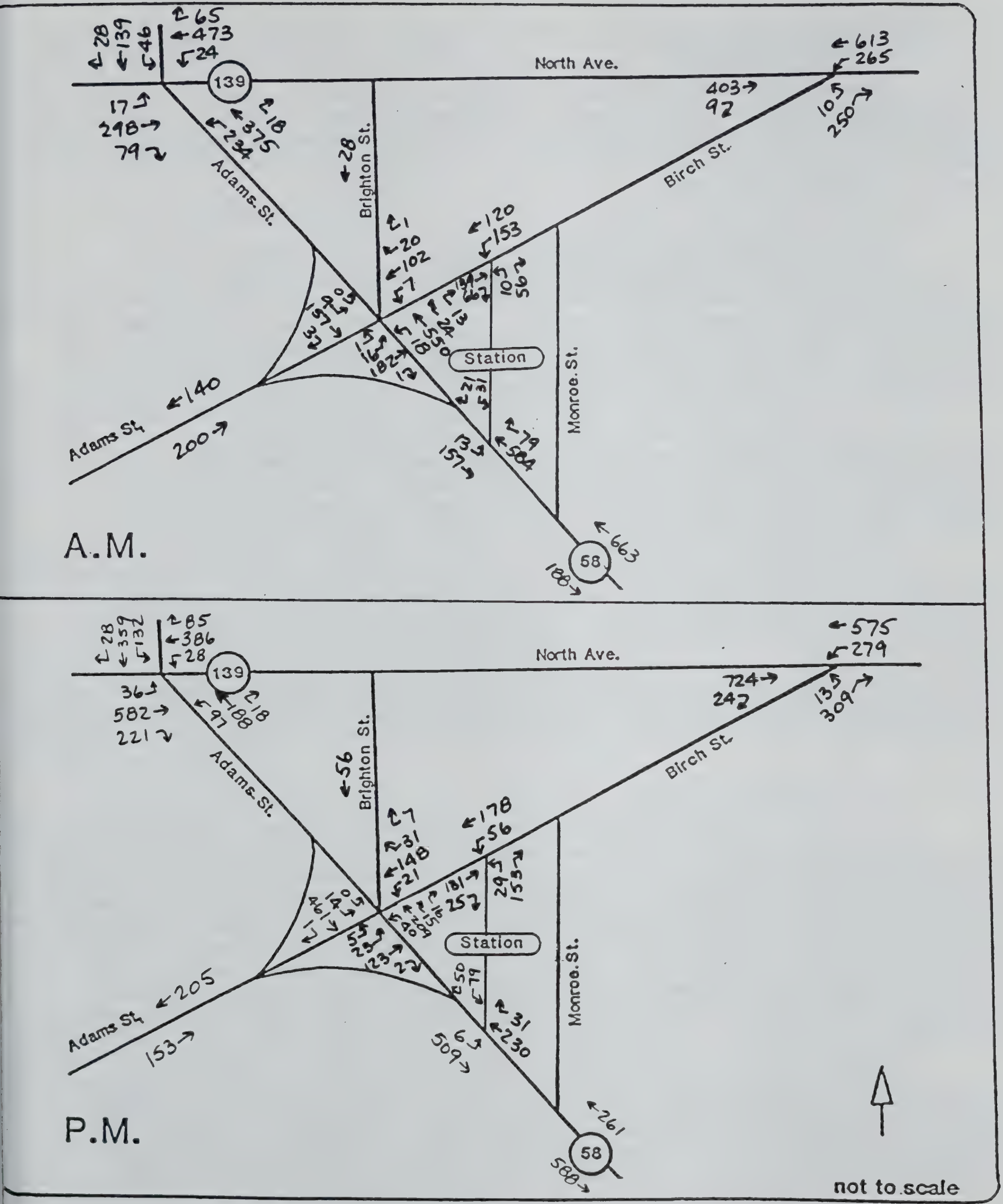

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FIG. 15-4
PLYMOUTH: Abington
TOTAL FUTURE TRAFFIC

16. Whitman Station and Line Segment from Abington-Whitman Line to Whitman-Hanson Line

This segment is located entirely within the town of Whitman, from the Abington town line to the Hanson town line, on the Plymouth Branch. It includes a proposed station location, on South Avenue (Route 27) west of Franklin Street. In addition, there are three grade crossings in this section; at Essex Street, South Avenue, and Franklin Street.

16a. Streets and Intersections

South Avenue, designated Route 27 in this location, is one travel lane in each direction with shoulders, sidewalks, and frequent curb cuts serving abutting businesses. Most such businesses have small off-street parking lots, but on-street parking is not explicitly prohibited here. Posted speed limit is 25 mph at the station entrance. Farther west, along South Avenue, the posted speed limit is 30 mph.

This area is east of the Whitman downtown business district. The center of town is the intersection of South Avenue with Washington Street, an unsignalized intersection with 4-way stop sign control. Activities are more densely-spaced, and on-street parking is more common, in the center of town than close to the station site.

Washington Street and Franklin Street (Route 27) are the principal north-south routes providing potential access to the station. Franklin Street is located east of the grade crossing; it terminates in an intersection with South Avenue and Pleasant Street. At this location, traffic can pass on either side of the former fire station building; and SB vehicles on Pleasant Street typically turn right onto South Avenue on the west side of that building, rather than at the intersection with Franklin Street. Stop and yield signs provide the only control at this location.

16b. Existing Traffic

Traffic volumes in the general area were observed to be low to moderate, without predominant directional splits (57 percent WB in AM Peak Hour, 58 percent EB in PM Peak Hour). Traffic slows down as it approaches the center of Whitman, because of on- street parking, pedestrian traffic; but no significant problems were observed. At South Avenue/Washington Street, short queues develop on all 4 legs because of driver uncertainty regarding right-of-way. Resulting delays may be quite long on some occasions, but were not observed to be a serious problem during our visits. This location is slated for signalization when funds become available.

Traffic counts were obtained for 3 intersections close to the proposed station location, South Avenue at Washington Street, South Avenue at Crescent Street and Park Street, and South Avenue at Franklin and Pleasant Streets. The results of these counts were annualized and balanced. They are presented on Figure 16-1 below.

The counts illustrate that a significant proportion of the total traffic at South Avenue/Franklin/Pleasant Street is the left-turn movement from Franklin onto South WB, particularly during the AM Peak Period. This movement is currently subject to minor delays principally associated with through traffic on South Avenue in both directions, rather than directly opposing flow from Pleasant Street. Should these opposing volumes or traffic on South Avenue increase, this left turn may become more constrained.

16c. Accident Experience

Traffic accident data for 1986 was obtained from the Whitman Police Department. Only accident incidence was recorded; information on types of accidents was not obtained. Table 16-1 summarizes accident incidence at critical locations in 1986.

At 2 locations, South/Franklin/Pleasant and South/Temple/Washington, an estimate was made of accident exposure using peak-hour turning movement counts factored to approximate total annual vehicles at each intersection. Peak hour volumes were assumed to be 10 percent of ADT, with total annual volumes estimated at 300 times ADT. The resulting rates (per million annual entering vehicles) are also presented in Table 16-1 at these 2 locations.

Compared with statewide averages (1.89 per million entering vehicles for signalized intersections, 0.95 per million entering vehicles for unsignalized intersections), the estimated levels at the 2 Whitman locations seem to be within reasonable levels.

16d. Future Growth Assumptions

To account for future growth in locally-generated and through traffic, a growth factor of 1 percent per year uncompounded, or 13 percent overall, was applied to 1986 traffic volumes. The resulting Base Year 2000 traffic volumes are as shown on Figure 16-2.

Given these growth assumptions, base Level of Service Analysis was applied to the intersections of South/Franklin/Pleasant Street and South/Washington/Temple Street, assuming existing geometric designs and stop-sign traffic controls. The results are presented for critical movements in Table 16-2. South/Washington/Temple is currently an unsignalized intersection, governed by 4-way stop signs. A traffic signal is at this location is already included in the region's transportation plan; so signalization was assumed for the analysis here.

The only movement for which areawide traffic growth will cause a noticeable deterioration compared with existing operations is the NB left turn from Franklin Street onto South Avenue. This occurs because of general growth in opposing traffic from the other 3 directions, and is more of a problem in the evening than the morning peak hour (even though the actual left-turn demand is itself lower in the evening).

Typically, left turns experiencing LOS E may be tolerated if other moves operate at high service levels (A or B); and if the left-turn demand is low enough so that queues of waiting left-turn vehicles are not likely to develop. In this case, although other moves can be accommodated quite well without further control, the left-turn demand would be high enough so that left-turn queues will certainly start to occur here at regular intervals during peak hours whether or not Old Colony commuter service is reactivated.

16e. Station Traffic

Patronage forcasts for a Whitman station, by mode of access, were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for Alternative 3b, Middleborough and Plymouth Lines only, were used to determine peak hour vehicle attractions to the station. The resulting boardings include 144 total daily parkers, with 68 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 86 parking vehicles arriving AM, departing PM, and 41 drop-off vehicles entering and exiting the station in each peak hour. the distribution of arrivals, based on towns of origin, are as shown on Figure 16-3. One station entrance only was assumed: on South Avenue.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already on South Avenue or other local streets.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 16-4, represent increases above Base 2000 volumes of 4 to 13 percent, depending on location and time of day. Level-of-Service results for each intersection under future volume conditions are shown in Table 16-2.

Essentially, station traffic results in little change to calculated Levels of Service, because station volumes are fairly low. At the South/Franklin/Pleasant Street intersection, station traffic represents an addition of only 54 vehicles in each peak hour to this intersection, so that the impact of station activity here is not major.

If this intersection is ultimately signalized, it will operate at LOS B or better.

16f. Grade Crossings

The three grade crossings in this section are located at Essex Street, South Avenue, and Franklin Street, with the South Avenue and Franklin Street crossings separated by about 1.5 miles. Traffic volumes were available for analysis of the South Avenue grade crossing; and volumes can be inferred from the existing counts for the Franklin Street crossing.

No counts were available for analysis of Essex Street. South Avenue volumes were assumed to represent a "worst-case" volume assumption for Essex Street as well, in order to compare resulting average and peak queue lengths with available distance from the grade crossing to the nearest intersections on both sides of the crossing.

The resulting queue-length analysis is summarized in Table 16-3.

The distances to the intersections closest to each grade crossing are presented in Table 16-4.

As the 2 tables suggest, only the 2 local streets (Raynor Street and Taylor Circle) will be blocked by vehicle queues at grade crossings. Both are low-volume minor streets, where short-term blockage will result in delays to a small number of exiting vehicles, but no more significant impact. Higher-volume streets in the area only have a negligible probability of being blocked by queues even under "worst-case" arrival conditions.

16g. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of full signalized gate controls at the three grade crossings in this segment.

- Street improvements--striping for left-turn lane on South Avenue WB at station entrance.

- Street improvements--Widening of Franklin Street and construction of a traffic island at South Avenue to permit separate left-turn, through, and right-turn lanes for northbound traffic in Franklin Street.

A conceptual plan for this improvement is shown in the DEIS, Chapter IX, Figure IX-C15.

TABLE 16-1

Accident Incidence at Whitman Intersections, 1986

Intersection	Numbers of Accidents	Rate per Million Entering Vehicles
South/Franklin/Pleasant	5	1.49
South/Pond	1	
South/Park	2	
South/Crescent	1	
South/Temple/Washington	5	1.07
TOTAL	14	
Total Town Accidents		252

TABLE 16-2

Level of Service Analysis
Whitman Station Area Intersections

Level of Service:
Year 2000 Traffic

Intersection	Currently Signalized	without Whitman Station AM	without Whitman Station PM	with Whitman Station (unimproved) AM	with Whitman Station (unimproved) PM
South/Franklin Pleasant					
--left turn from Franklin*	NO	D	F	E	F
South/Franklin/ Pleasant					
--as signalized intersection	YES	B	B	B	B
South/Washington/ Temple	YES**	B	B	B	B

*other moves all LOS A or B
**traffic signal included in transportation program assumed installed

TABLE 16-3

Queuing Analysis
Whitman Station/Line Segment Grade Crossings

	Peak Hour Approach Volume	Ave. 90-Sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	"Peak" Queue Length, (ft.)	Avg. Delay per stopped vehicle (sec.)
1. South Avenue					
--EB					
AM Peak Hour	391	10	15	330	55
PM Peak Hour	759	19	24	530	64
--WB					
AM Peak Hour	585	15	20	440	60
PM Peak Hour	583	15	20	440	60
2. Franklin St. (est.)					
--NB					
AM Peak Hour	316	8	12	260	53
PM Peak Hour	274	7	11	240	52
--SB					
AM Peak Hour	227	6	10	220	51
PM Peak Hour	407	10	15	330	55

TABLE 16-4

Grade Crossings--Distances to Nearest Intersections

1. South Avenue	
--to Pleasant/Franklin Streets (E)	550′
--to Raynor Street (E)	195′
--to Cole Brook Boulevard (W)	550′
2. Franklin Street	(no nearby intersections)
3. Essex Street	
--to Taylor Circle (E)	55′
--to Route 58 traffic circle (E)	940′

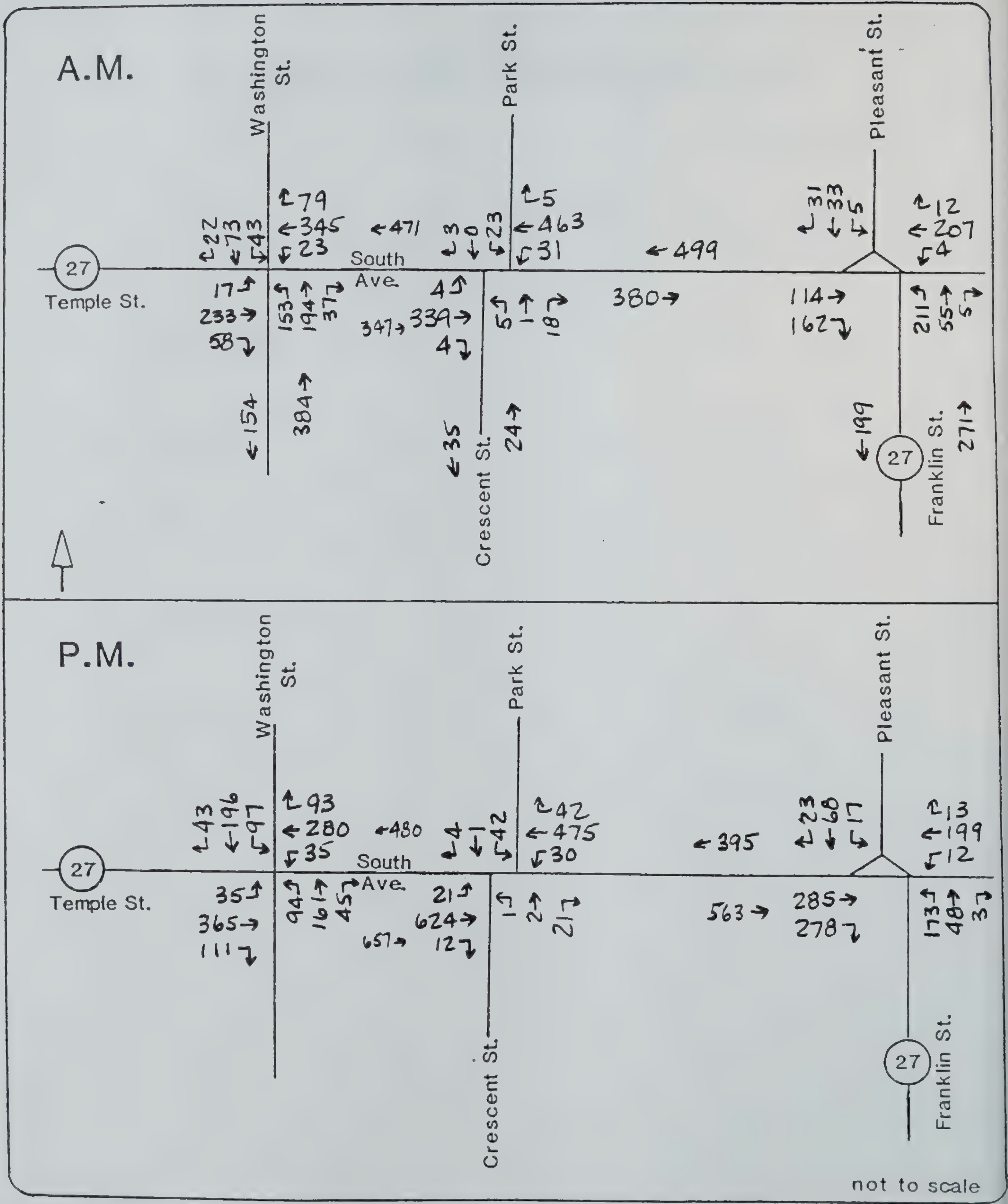

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FIG. 16-1
PLYMOUTH: Whitman
Existing Traffic

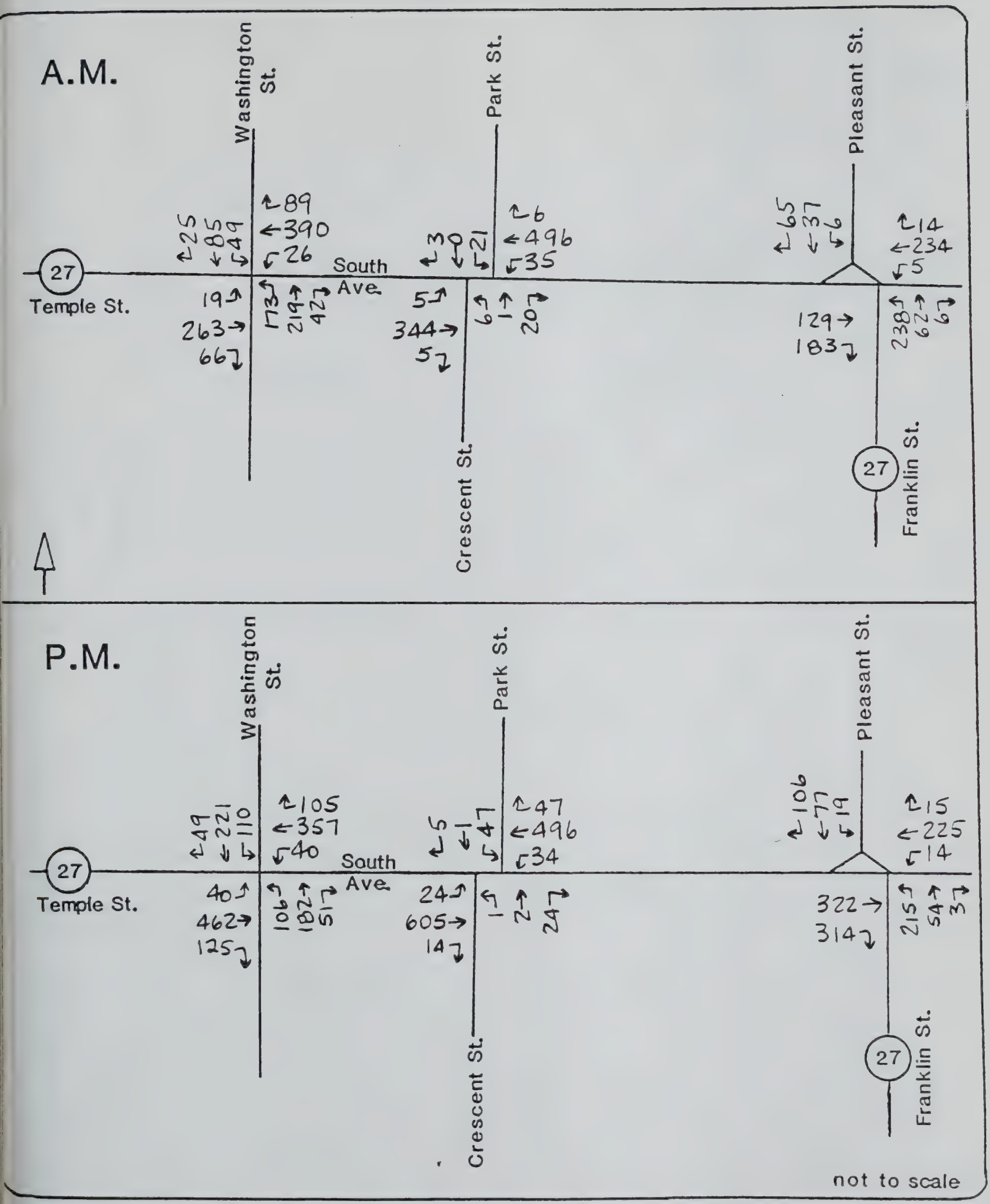

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FIG. 16-2
PLYMOUTH: Whitman
Year 2000 Base Traffic

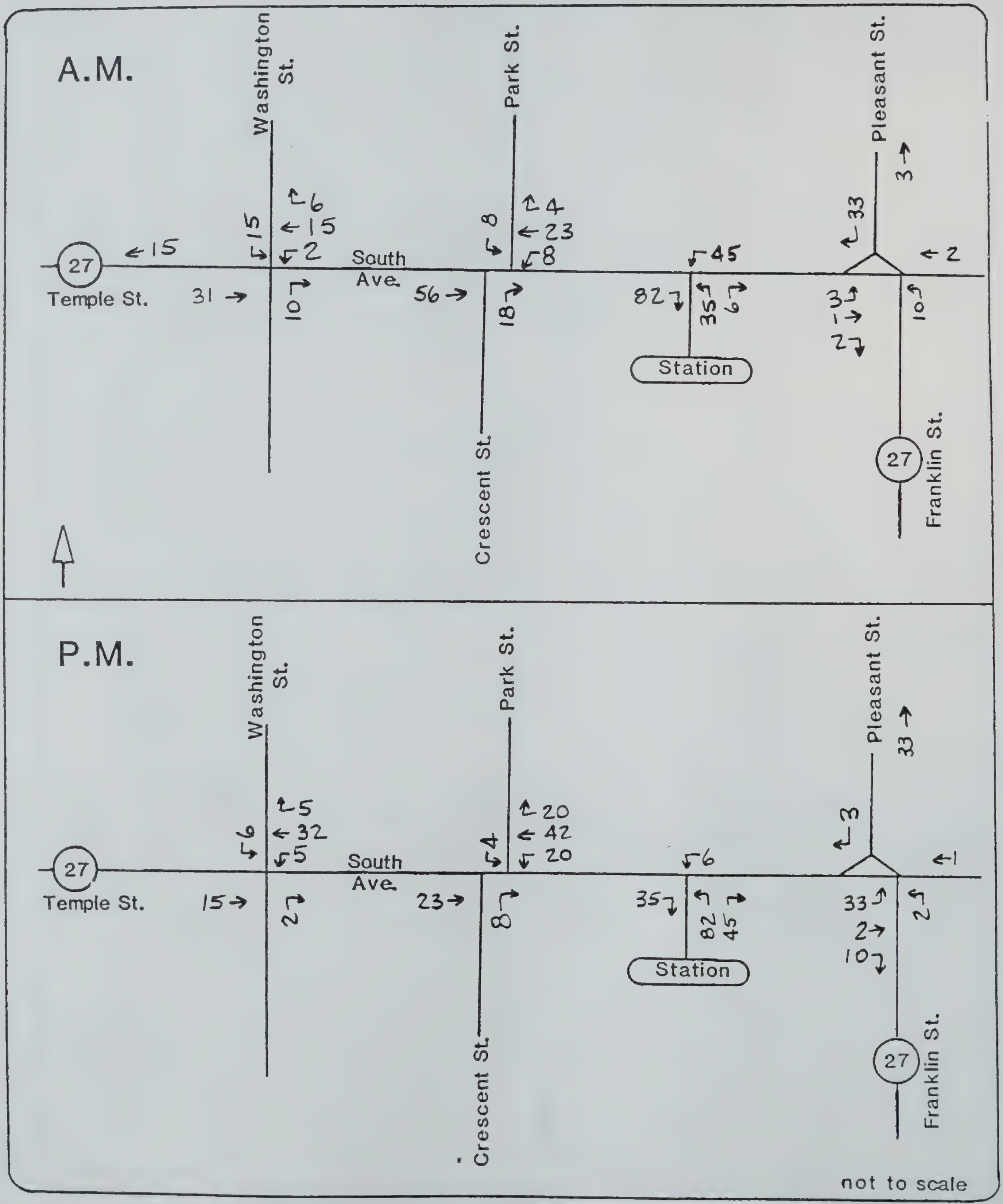

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FIG. 16-3
PLYMOUTH: Whitman
Station Traffic

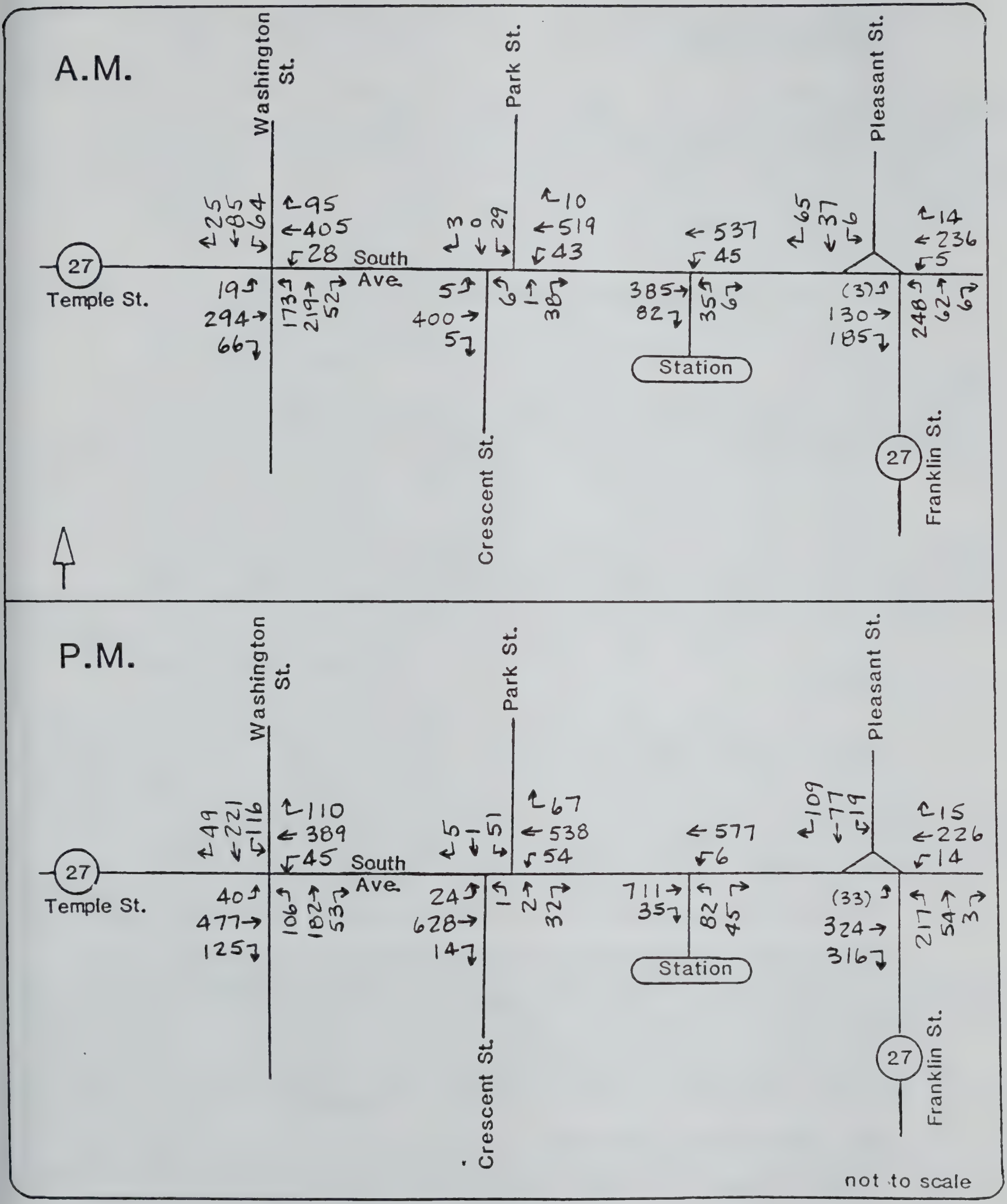

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FIG. 16-4
PLYMOUTH: Whitman
Future Traffic,
with Station

17. South Hanson Station and Line Segment from Whitman-Hanson Line to Hanson-Halifax Line

This report covers the segment from the Whitman-Hanson town line to the Hanson-Halifax town line, on the Plymouth Branch. This section contains 5 grade crossings, at West Washington Street, Main Street, Crooker Road, private crossing here Pleasant Street, and Monponsett Street; in addition to a station, located off Main Street (Route 27) close to the site of the former station. The primary street traffic impact would result from station operations; however, delays will be experienced at grade crossings, particularly at the Main Street crossing.

17a. Existing Streets and Intersections

Streets in the Hanson area, including Main Street (Route 27), are generally two-lane, rural-type roadways which carry low traffic volumes. Main Street itself serves as an east-west collector roadway providing access to the principal north-south regional arterials. The areas traversed by these roads are fairly sparsely developed, with few intersecting streets or driveways. Travel speeds, therefore, tend to be higher than the posted speed limits, which are 35-45 mph.

Adjacent to the station is the intersection of Phillips and Main Streets. Phillips Street is a secondary street serving primarily the nearby residential neighborhoods. It meets Main Street at an oblique-angle 3-way intersection. Right turn movements out of the street onto Main Street will add to the queue at the grade crossing.

Farther west, past the station location, Elm Street meets Main Street in a "T" intersection.

17b. Existing Volumes

No pre-existing counts were available for this location. Hence, Peak Hour turning movement traffic counts were obtained at the intersections of Phillips Street and Main Street, and Elm Street and Main Streeet. Balanced traffic volumes for 1987 can be found in Figure 17-1.

17c. Accident Experience

Accident data was collected for a number of intersections within Hanson from the Old Colony Planning Council files. 1986 was the only complete year available from these records. Table 17-1 summarizes the reported accidents at relevant intersections for that year.

These numbers do not appear unusual or problematic, although it is difficult to draw conclusions about any location without information on exposure.

17d. Future Growth Assumptions

No specific local development projects were included in growth forecasts. However, this area is anticipated to experience greater-than-average growth over the next twenty years. Therefore, for purposes of this analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 1.4 percent per year, or 32.2 percent overall, uncompounded, were computed and are presented in Figure 17-2.

From these growth levels, future Levels of Service (LOS) were calculated for the principal intersections in the station area. These intersections are Main/Phillips Streets, and Main Street at the station driveway. The resulting LOS are depicted in Table 17-2.

For unsignalized intersections, LOS results are calculated separately for each critical move. Values of "E" for left turns from minor streets to major ones indicate the delays commonly experienced by those vehicles waiting for gaps in 2-way opposing traffic streams.

17e. Station Traffic

Patronage forecasts for a Hanson station by mode of station access were produced for two rail alternatives as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for Alternative 3b, Middleborough and Plymouth Line only, were used to determine peak hour vehicle attractions to the station. This forecast resulted in an estimate of 99 daily parkers and 50 drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals, or 60 parking vehicles arriving AM, departing PM, and 30 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown in Figure 17-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Main or other streets. Realistically, however, it is more likely that some station traffic is traffic which would otherwise use local streets for commuter trips.

The sum of Base Traffic and station traffic yields an estimate of Total Year 2000 traffic volumes, as depicted in Figure 17-4. These future volumes represent increases above Base 2000 volumes of approximately 1 to 12 percent on Main Street, depending on location and time of day.

Level of Service results for each intersection under future volume conditions are shown in Table 17-2. These results by themselves suggest that operations at the 2 intersections will be quite adequate from a delay perspective: exiting left-turn volumes will be delayed, but other movements, including left turns into both the station entrance and Phillips Street, will operate smoothly and with little delay. Generally, queues turning into the station and Phillips Street will not be long enough to interfere with each other.

However, the LOS procedure is not sensitive to the proximity of the station entrance to the grade crossing during a train passby. Without additional controls, it is possible that the rear of a several-vehicle queue waiting to turn left into the station will straddle the track when a train passby is imminent. There is insufficient distance for even a 2- or 3-car queue to clear the track.

Consequently, it is proposed to install a traffic signal at this location which would operate on flashing-yellow except when an approaching train is sensed. This would trigger a pre-emption sequence which would stop thorugh westbound traffic and allow left-turns to proceed into the staiton.

This proposal is discussed at greater length below.

17f. Grade Crossings

Five grade crossings are found in this line segment: at West Washington Street, Main Street adjacent to the proposed station entrance, Crooker Road, Pleasant Street, and Monponsett Street. All 5 would be equipped with full grade protection.

Of the 5, the Crooker Road and Pleasant Street crossings are located on minor streets with low traffic volumes, serving primarily local residential traffic. While vehicles will be stopped by train passbys at these locations, the numbers of vehicles involved are low, and there is no danger at either location that traffic queues will build up far enough to impede other nearby intersections.

The only intersection within range of vehicle queues along Monponsett Street is Woodbine Avenue, approximately 140 feet south of the track. Woodbine is a minor residential street which provides access to a small number of homes. Within 800 feet of its intersection with Monponsett, Woodbine becomes a dirt road, with slow passage required for typical non-4-wheel-drive passenger cars. Blockage of Woodbine Avenue during train passbys will not represent a major inconvenience or danger.

The remaining 2 grade crossings occur on numbered routes--West Washington Street (Route 14) and Main Street (Route 27). No traffic volume information is available for West Washington Street; but this street appears to be similar in character to Main Street, with less development, lower speeds, and, consequently, lower traffic volumes. It was decided to approximate queue lengths on West Washington Street by assuming similar traffic volumes to Main Street, where volume information is available; and to compare the resulting queue lengths with the available distance to nearest intersection on West Washington.

The grade crossing on West Washington is approximately 1,400 feet from the intersection of West Washington/Franklin Street (Route 27), the nearest significant intersection. On Main Street, east of the track, the station entrance and Phillips Street are the closest intersections-- approximately 80 and 280 feet respectively from the track. West of the track, there are no nearby intersections before Elm Street, almost one-half mile away.

With Old Colony commuter service through this area, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. The proposed schedule calls for half-hour commuter-train headways on the Plymouth Line during peak hours, with less-frequent service during off-peak hours. Consequently, a maximum of 3 passbys per peak traffic hour are anticipated on this line.

Analysis was performed to estimate average and maximum length of queues and average delay per stopped vehicle at the Main Street grade crossing. On Main Street EB, the sum of left turns and through vehicles was considered to use the existing single lane approach to queue back from the track; but left turns into the station were also analyzed separately to estimate queues back from the station entrance. The results of this analysis are presented in Table 17-3.

On average, 14 vehicles will arrive in the WB direction in the AM Peak Hour, and 16 in the EB direction during the PM Peak. The so-called "peak" 90-second arrival rate represents the 95th percentile vehicle arrivals per 90 second period, assuming that arrivals are random. Under this "peak" scenario, no vehicle queues will extend back from the track far enough to reach any significant intersection on either Main Street or West Washington, assuming comparable volumes on the 2 streets, except for the following:

- On the WB Main Street approach, both the station entrance/exit and Phillips Street will be blocked by vehicle queues during most peak-hour passbys.

- On the EB Main Street approach, access for fire and emergency vehicles from the station on the south side of Main Street will be blocked.

- In addition, if more than 1 or 2 vehicles arrive in the EB direction to turn left from Main Street into the station, the end of this short queue has a very small but existent risk of being blocked across the track when a passby is imminent.

The first 2 of these conditions represent increased delay to affected vehicles, which may be regarded as acceptable costs. The last represents a condition of unacceptable risk, even if this risk is minimal because of the extremely low left- turn vehicle volumes anticipated on average. In order to eliminate the possibility of left-turn queues blocked across the track when a train passby is expected, the traffic signal installation mentioned above is proposed.

The primary purpose of this signal would be to provide emergency control of Main Street EB traffic, stopping this traffic to allow free-flow of Main Street left turns into the station when a train passby is imminent. Stop lines would be located west of the track on the Main St. WB approach, and east ofthe station driveway on the EB approach. Once the clearance interval has allowed waiting left turns to clear the track, the signal would function like any traffic signal close to a grade crossing, returning to flashing yellow at the end of the pre- emption sequence.

At all other times, the signal would show flashing yellow indications to Main Street, similar to the operation of pedestrian signals at school crossing locations.

The average delay per vehicle stopped at a crossing will be half the train passby time plus the start-up time of the median vehicle in the queue, or a maximum of approximately 1 minute on Main Street EB in the PM Peak Hour.

17g. Mitigation Measures

The following traffic measures are recommended:

- Grade Crossing Controls--installation of full gate crossing controls at all five grade crossings; signalization at the Main Street grade crossing, as described.
- Street Improvements--provision of separate left-turn and through traffic lanes on EB approach as shown in DEIS, Chapter IX, Figures IX-C16.

TABLE 17-1

Accident Data, Town of Hanson

Location	Reported Numbers of Accidents 1986
Main/Phillips	0
Phillips Street (general)	1
Holmes/Phillips	0
Holmes Street (general)	4
Holmes/High	0
West Washington/County/Holmes	4
Total Townwide Accidents	440

TABLE 17-2

Level of Service Analysis
Hanson Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service: Year 2000 Traffic without Hanson Station AM	without Hanson Station PM	with Hanson Station AM	with Hanson Station PM
Main/Phillips					
Left turn from Main into Phillips NB	NO	A	A	A	A
Left turn from Phillips into Main EB	NO	C	D	D	E
Right turn from Phillips into Main WB	NO	A	A	A	A
Main/Station Driveway					
Left turn from Main into Station NB	NO	-	-	A	A
Left turn from Station into Main EB	NO	-	-	D	E
Right turn from Station into Main WB	NO	-	-	A	A

TABLE 17-3

Queuing Analysis: Hanson Grade Crossings

	Year 2000 Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)
1. Main Street				
AM Peak Hour				
WB Approach	553	14	19	420
EB Approach	309	8	13	285
Lefts into station	5	.13	<1	<22
PM Peak Hour				
WB Approach	504	13	18	400
EB Approach	628	16	21	460
Lefts into station	1	.03	<1	<22
2. Monponsett Street				
AM Peak Hour				
NB Approach	384	10	15	330
SB Approach	167	4	9	200
PM Peak Hour				
NB Approach	332	8	13	285
SB Approach	479	12	17	375

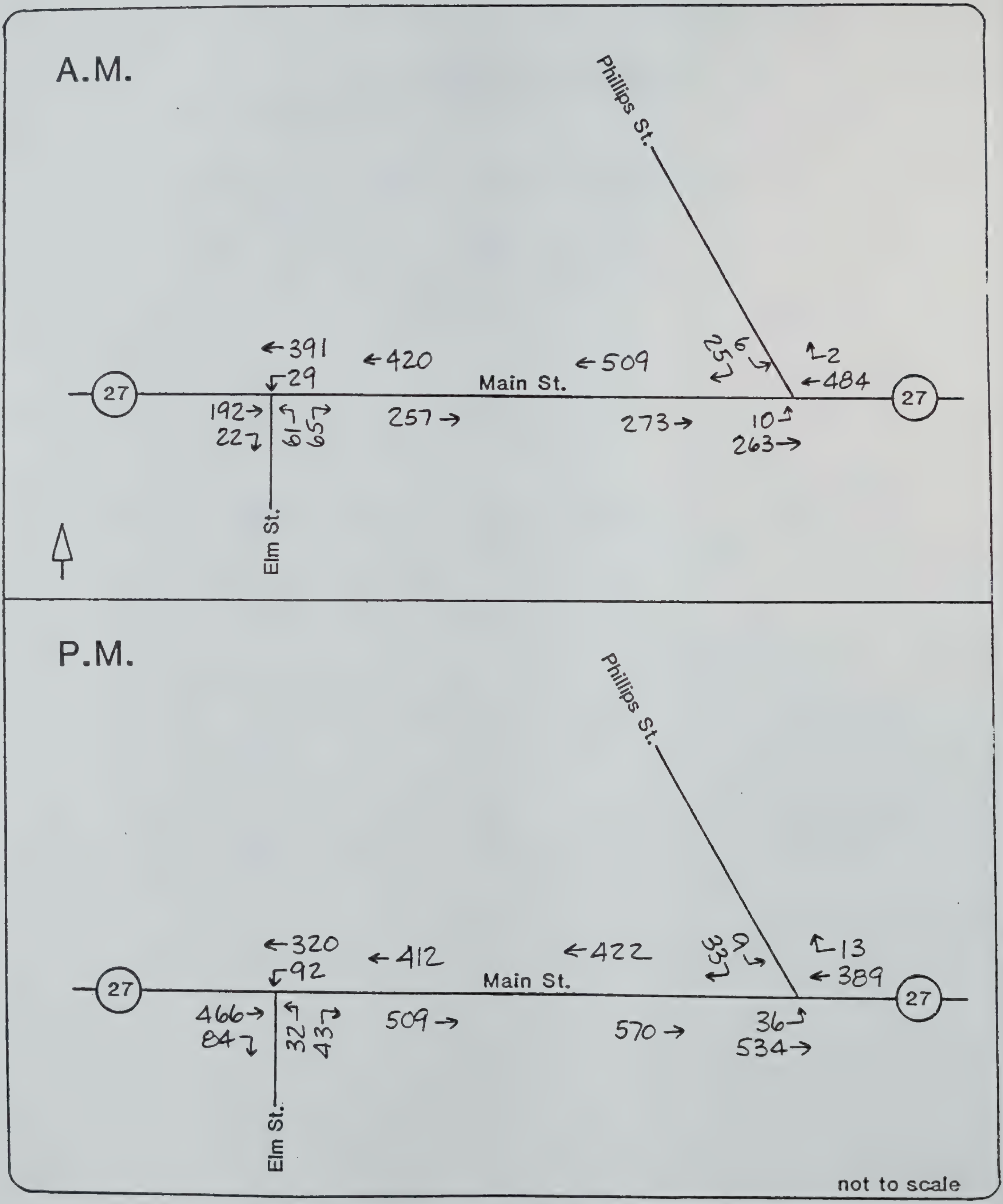

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FIG. 17-1
PLYMOUTH: Hanson
EXISTING TRAFFIC

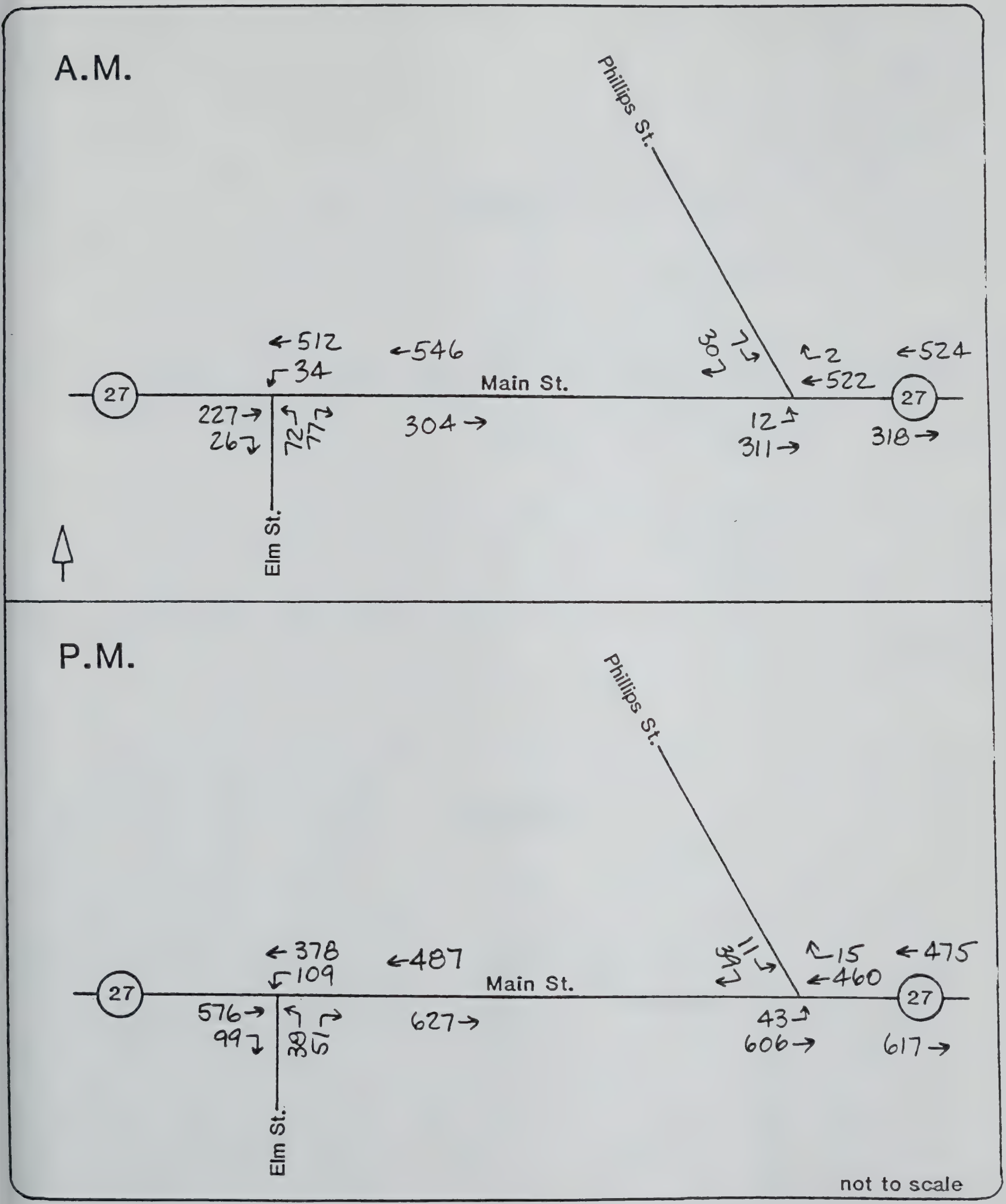

FIG. 17-2
PLYMOUTH: Hanson
YEAR 2000 BASE TRAFFIC

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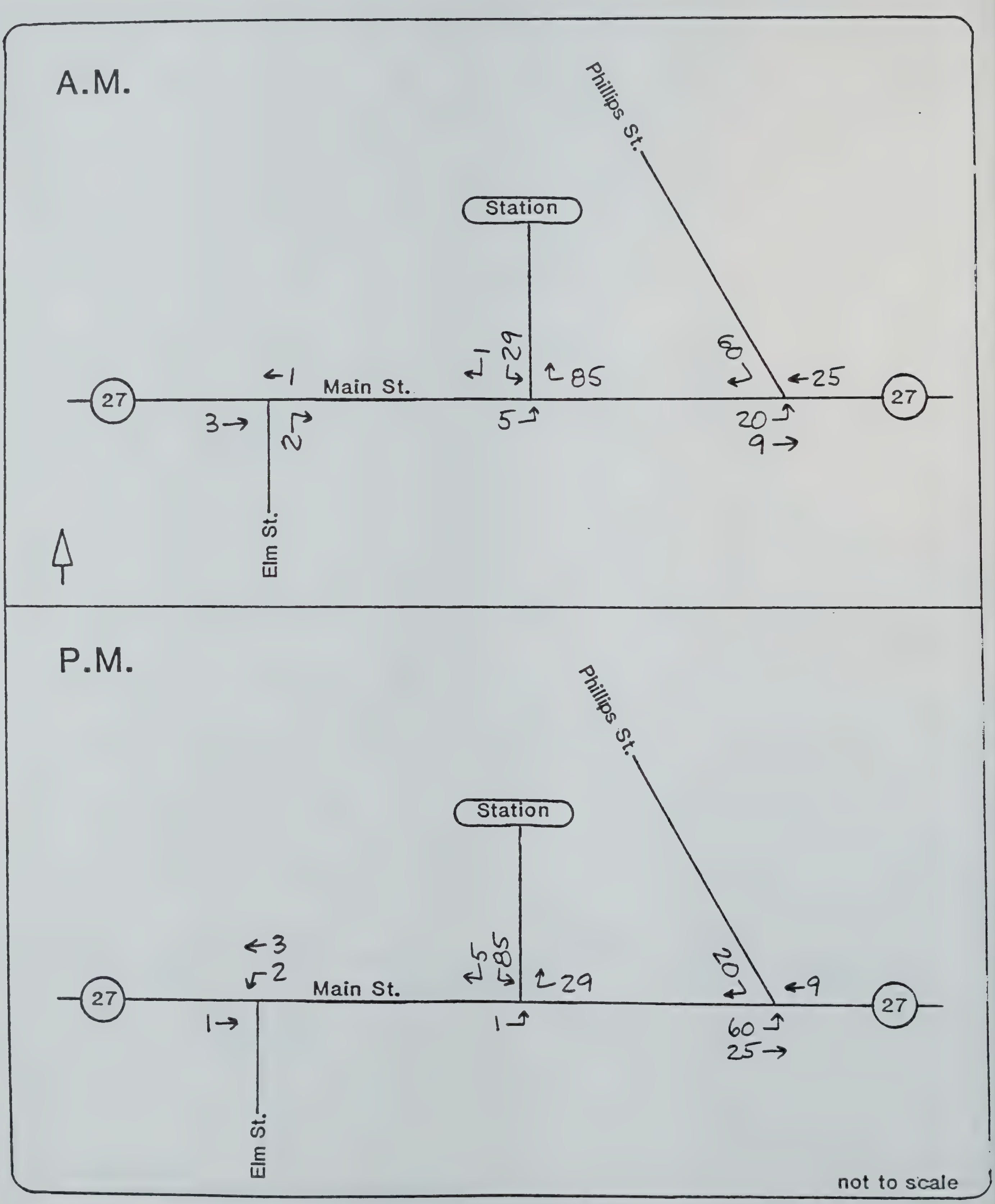

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FIG. 17-3
PLYMOUTH: Hanson
STATION-GENERATED
VOLUMES

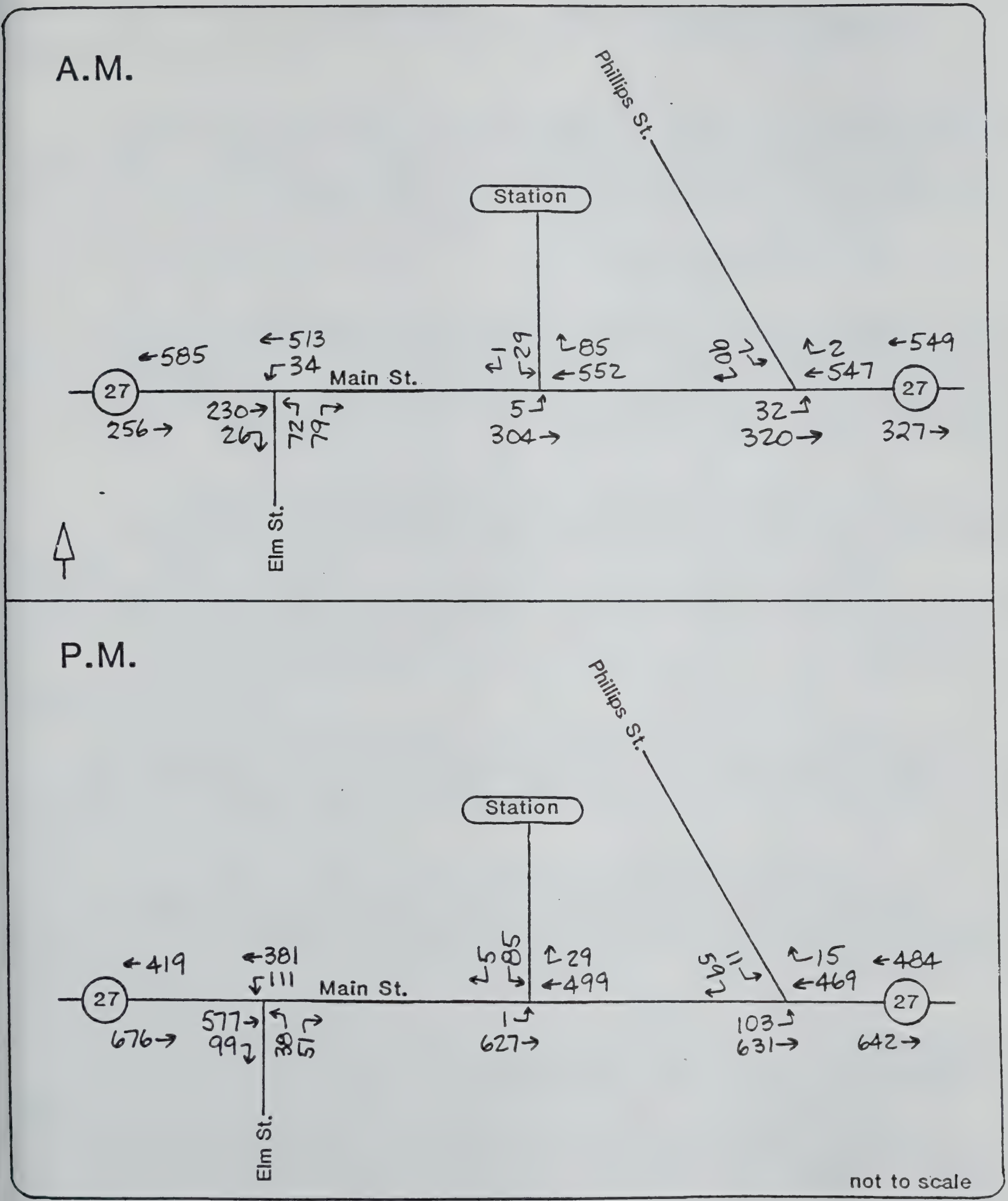

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FIG. 17-4
PLYMOUTH: Hanson
FUTURE TRAFFIC WITH STATION

18. Halifax Station and Line Segment from Hanson-Halifax Line to Plympton-Kingston Line

This segment extends from the Hanson-Halifax town line to the Plympton-Kingston town line on the Plymouth Branch. This segment includes a single grade crossing, at Holmes Street, with a station site located off Garden Street on the site of an abandoned commercial rose farm. Traffic impacts are associated both with the proposed station and the grade crossing.

18a. Existing Streets

Streets in the Halifax-Monponsett area, including Holmes (Route 36), Oak, and Plymouth (Route 106) Streets, are generally 2-lane, rural-type collector roadways which carry low traffic volumes. This is particularly true during the non-summer seasons, since this is a largely recreational area attracting summer vacation traffic. The areas traversed by these roadways are fairly sparsely developed, with few intersecting streets or driveways. Travel speeds, therefore, tend to be higher than the posted speed limits, which are 35-45 mph.

Holmes Street meets Plymouth Street in a "T" intersection, also unsignalized. Plymouth Street serves a minor arterial function, it is a higher-grade facility with higher posted speeds than Holmes or Oak Streets.

Garden Road, a minor street off Holmes Street which would provide direct access to the station, currently enters Holmes Street at an acute angle, ascending to the street at a grade of 3-4 percent. The angle and grade would need to be modified in order to allow use of the street for station access.

18b. Existing Volumes

No pre-existing counts were available for this location. Hence, new Peak Hour turning movement traffic counts were obtained at the intersections of Holmes Street with Plymouth and Oak Streets. Balanced traffic volumes for 1987 can be found in Figure 18-1.

18c. Accident Experience

Town of Halifax Police Records were consulted to determine accident experience at intersections of concern near the proposed commuter rail station. Recorded accidents for Calendar year 1986 and January-July 1987 at these locations are summarized in Table 18-1.

During 1986, 11 of the total 15 accidents at these locations (73 percent) occurred either late in the evening (9:00 p.m. or later) or early in the morning (1:00 or 2:00 a.m.). Accidents tended to involve property damage rather than injuries, and several were single-vehicle collisions with stationary objects.

At no location was the number of annual accidents unusually high (with the possible exception of Oak/Holmes). In order to make a reasonable judgment about this, however, degree of exposure was considered by examining accidents per million vehicles entering an intersection. A rough estimate of accidents per million entering vehicles was computed, assuming that: a) Peak Hour volumes are 10 percent of Average Weekday Daily Traffic (AWDT); and b) annual entering volume is 300 times AWDT.

Based on a comparison of such rates, Holmes/Oak Street was well above average for 1986, with a rate of 5.24, compared with the statewide annual average accident rate per million entering vehicles for unsignalized intersections, estimated by CTPS (0.95). At the time of this initial accident review, police personnel remarked on the elevated numbers of accidents at the Holmes/Oak Street intersection, attributing this to limited sight distance for vehicles on Oak Street: Holmes Street traffic cannot be seen by Oak Street drivers until they are already in the intersection.

A follow-up investigation was undertaken in August 1989 to perform an accident type study at Holmes/Oak Street, and to update previous accident data. Since the previous study, a stop sign had been added, and trees bordering the intersection had been cut back. As a result, accident incidence at this location has been reduced dramatically, with no reported accidents in 1988.

18d. Future Growth Assumptions

No specific local development projects were included in growth forecasts. However, this area is anticipated to grow rapidly over the next 20 years. Therefore, for purposes of this analysis, assumed Year 2000 traffic volumes, based on an areawide growth factor of 3.6 percent per year, were computed, and are presented in Figure 18-2.

From these growth levels, future Levels of Service (LOS) were calculated for the primary intersections in the station area. The resulting levels are presented in Table 18-2.

For unsignalized intersections, LOS results are calculated separately for each critical move. Values of "E" for left turns from minor streets to major ones indicate the delays commonly experienced by those vehicles waiting for gaps in heavy opposing traffic streams.

As Table 18-3 indicates, all locations are expected to operate adequately under future Base conditions with the exception of vehicles making left turns from Holmes Street into Plymouth Street eastbound during the morning peak hours. This is because traffic volumes on Plymouth Street are relatively high during peak hours and adequate gaps for left-turning traffic from Holmes Street occur infrequently.

18e. Station Traffic

Patronage forecasts for a Halifax station by mode of station access were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for alternative 3b, Middleborough and Plymouth Lines only, were used to determine peak hour vehicle attractions to the station. This forecast resulted in an estimate of 136 daily parkers and 57 drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals, or 83 parking vehicles arriving AM, departing PM, and 34 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown in Figure 18-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Holmes or other streets. Realistically, however, it is more likely that some station traffic is traffic which would otherwise use local streets for commuter trips.

The sum of Base Traffic and station traffic yields an estimate of Total Year 2000 traffic volumes as depicted in Figure 18-4. These future volumes represent increases above Base 2000 volumes of approximately 7 to 36 percent on Holmes Street, depending on location and time of day.

Level of Service results for each intersection under future volume conditions are shown in Table 18-2. This table indicates that the Level of Service at all locations will remain adequate with little or no change in LOS grade, but with slight increases in delays as a result of added traffic.

18f. Grade Crossings

The single grade crossing in this section is located on Holmes Street, just north of Garden Road. This crossing will be equipped with full gate protection.

Analysis was performed to estimate average and maximum length of queues and average delay per stopped vehicle at this crossing. The results of this analysis are presented in Table 18-3.

The closest nearby intersection other than Garden Street is at Aldana Street, over 1,100 feet south of the track. Traffic queues resulting from grade crossing activation, therefore, will not back far enough to interfere with operation of any intersection, apart from Garden Road. Access to Garden Road from Holmes Street SB (and the Halifax Fence Company driveway) will be blocked by all train passbys. Similarly, access from Garden Road to Holmes Street NB will be blocked by all train passbys. With the introduction of the mitigation measures described below, when Garden Road movements should remain free flowing.

The average delay per vehicle stopped at a crossing will be half the train passby time plus the start-up time of the median vehicle in the queue, or a maximum of approximately 56 seconds on Holmes Street SB in the AM Peak Hour.

18g. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of full gated crossing controls at the Holmes Street grade crossing.

- Street improvements--realign Garden Road to provide a 90-degree approach to Holmes Street, with an approach grade as flat as practicable for at least 50 feet back from Holmes, and with a width sufficient to provide separate left and right turn lanes. Provide adequate pavement width on Holmes Street SB to act as de facto deceleration lane for right turns into station and on Holmes Street NB to provide a left turn lane at Garden Road.

- Improvements to Oak/Holmes Streets to improve sight distance--needs more detailed accident analysis.

Conceptual plans for these improvements are shown in the DEIS, Chapter IX, Figure IX-C17.

TABLE 18-1

Accident Incidence from Halifax Police Records

Intersection	Number of Recorded Accidents 1986	Number of Recorded Accidents 1987*
Holmes/Plymouth	3	2
Holmes/Oak	9	3
Holmes/RR Tracks	3	0
Total townwide accidents	210	141

*through July

TABLE 18-2

Level of Service Analysis:
Halifax Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service: Year 2000 Traffic — without Halifax Station AM	PM	with Halifax Station AM	PM
Plymouth/Holmes					
Left turn from Plymouth into Holmes NB	NO	A	A	B	A
Left turn from Holmes into Plymouth EB	NO	E	C	E	C
Right turn from Holmes into Plymouth WB	NO	A	A	A	A
Holmes/Oak					
Left turn from Holmes into Oak EB	NO	A	A	A	A
Left turn from Holmes into Oak WB	NO	A	A	A	A
Left turn from Oak into Holmes NB	NO	C	B	D	B
Shared through/right turn from Oak WB to Oak EB/Holmes SB	NO	A	A	A	A
Left turn from Oak into Holmes SB	NO	B	B	C	B
Shared through/right turn from Oak EB to Oak WB/Holmes NB	NO	B	A	B	A

TABLE 18-3

Queuing Analysis: Holmes Street Grade Crossing

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)
AM Peak Hour				
Holmes NB	232	6	11	240
Holmes SB	425	11	16	350
PM Peak Hour				
Holmes NB	316	8	13	285
Holmes SB	169	4	9	200

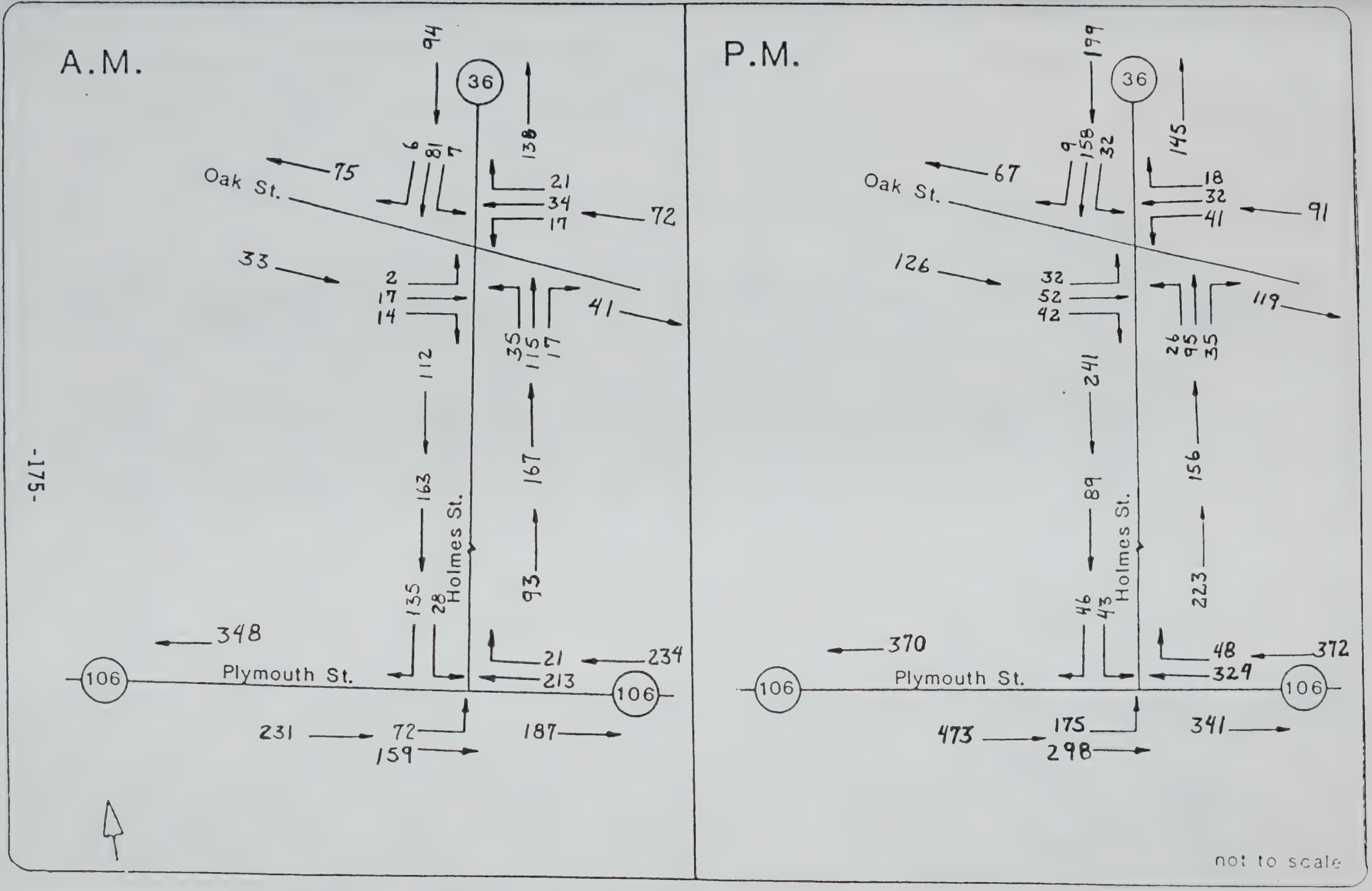

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FIG. 18-1

PLYMOUTH:

HALIFAX

EXISTING TRAFFIC

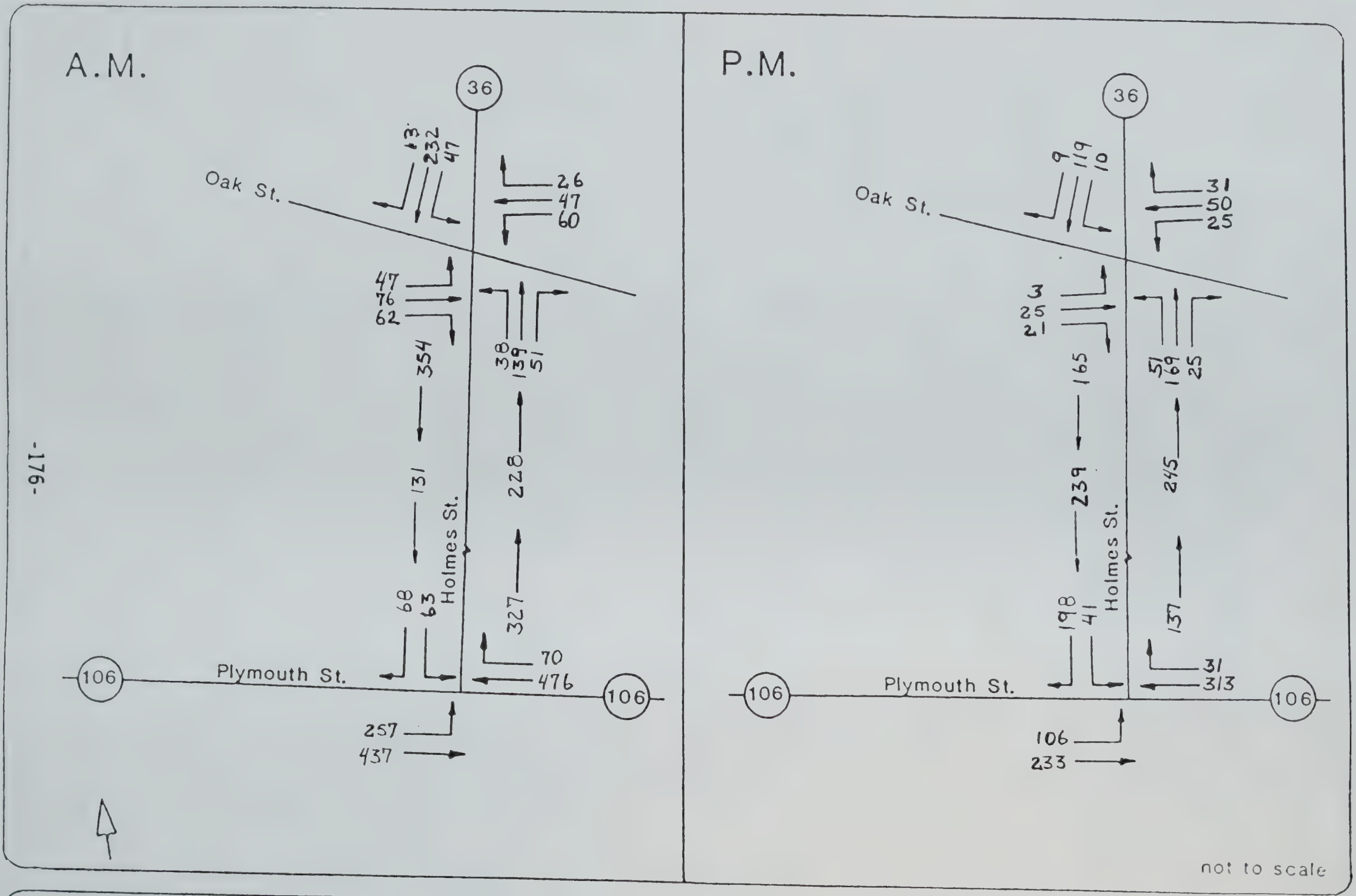

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FIG. 18-Z

PLYMOUTH:

HALIFAX

YEAR 2000 BASE

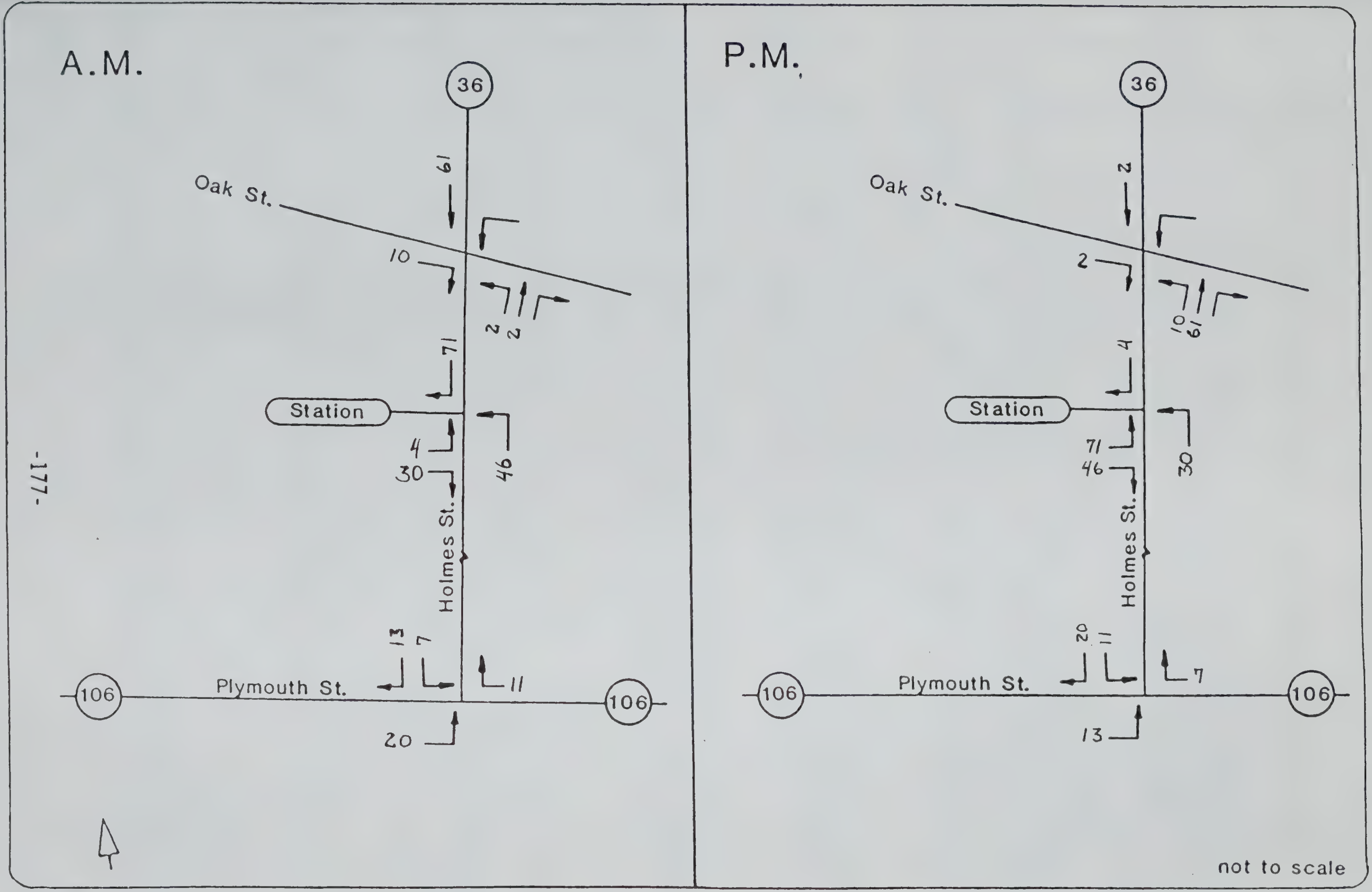

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FIG. 18-3

PLYMOUTH:

HALIFAX
STATION VOLUMES

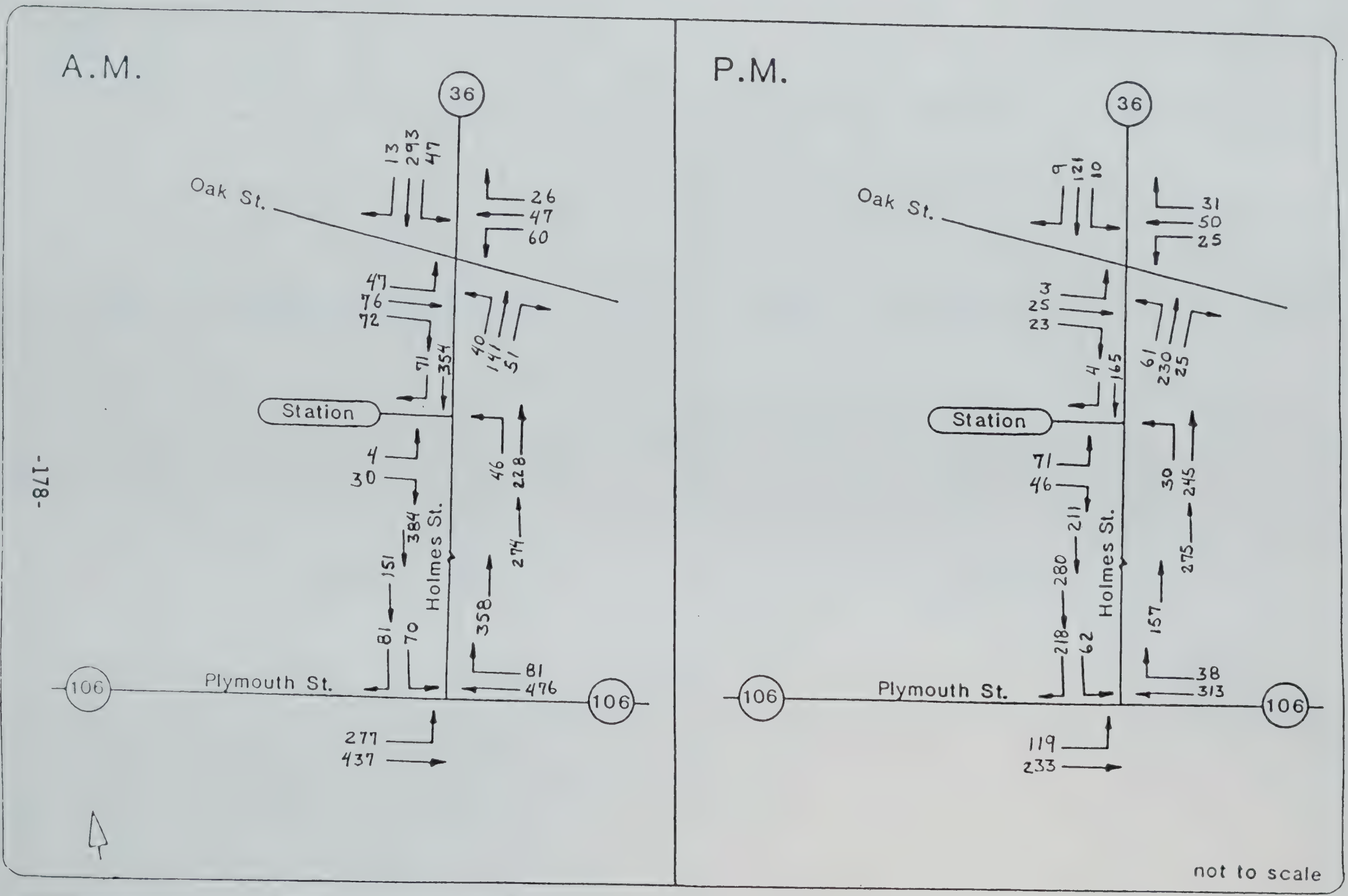

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FIG. 18-4

PLYMOUTH:

HALIFAX

YEAR 2000 WITH STATION

19. Line Segment from Plympton-Kingston Line to Jones River Crossing

This segment extends from the Plympton-Kingston Town Line to the Jones River crossing, on the Plymouth Branch. It includes two grade crossings, at Lake Street and at Summer Street (Route 3A). The primary street traffic impact within this section would be associated with the Summer Street grade crossing.

19a. Existing Streets and Intersections

Route 27 is an east-west arterial street, 2 travel lanes wide for most of its length. As Route 27 approaches Main and Evergreen Streets, the street narrows, and both the intensity of abutting uses and the frequency of driveways increase. The intersection of these several streets--Pembroke (Route 27), Main (Route 106), and Evergreen--is an awkward, offset intersection with poor sight lines and ambiguous stop sign control. The Pembroke Street approach to this offset intersetion has 1 travel lane in each direction, and vehicles turning left into Evergreen Street tend to block through traffic.

Route 106 (Wapping Road/Main Street) is a 2-lane east- west arterial. East of the Pembroke/Evergreen Street intersection, it enters another substandard intersection at Summer Street (Route 3A). Here, poor sight lines and roadway geometry contribute to hazardous conditions and traffic delays, particularly for heavy peak-hour volumes on Route 3A.

Evergreen is also 2 travel lanes wide, serving mainly residential abutters and the Town Public Works facility, but also used by through traffic as a direct connection between Routes 27/106 and 3A. The intersection of Evergreen Street and Route 3A is in the center of the Kingston local business district, with related activity, congestion, and on-street parking, as well as the grade crossing.

Finally, Route 3A (Summer Street) is an arterial roadway, 1 lane in each direction, with 2-lane approaches at some intersections. All intersections in this area are at-grade. Its cross-section width and posted speeds vary with the character of the area it passes through. In Kingston Center, it operates as a local street through a built-up area, with on-street parking, numerous curb cuts, and intersections in the vicinity of the grade crossing.

19b. Existing Traffic

Peak-period turning movement traffic counts were performed at several locations during 1986-87. The available count data were assembled, balanced, and annualized to represent Average Daily Traffic volumes. Figure 19-1 displays these volumes as "Existing Traffic."

19c. Accident Data

Kingston Police Department accident records were obtained from the Old Colony Planning Council for this area. Accident experience at key intersections is summarized in Table 19-1 below.

The accident totals at three locations are noteworthy, two Summer Street intersections with Evergreen and Main Street, and the Pembroke/Main/Evergreen Streets intersection. At each of these three, an estimate of accident rate per million entering vehicles was calculated, using existing counts and assuming that: 1) peak hour volumes are 10 percent of AWDT, and 2) total annual volume entering each intersection is 300 times AWDT.

The resulting estimates at each intersection were:

- Summer/Evergreen	1229	3.7	7	1.9
- Summer/Main	1843	5.5	32	5.8
- Pembroke/Main/ Evergreen	1573	4.7	19	4.0

At each location, observed values exceeded the relevant averages, with Summer/Main and Pembroke/Main/Evergreen far in excess of statewide averages.

No detailed analysis of accident types was undertaken as part of the current study. However, it appears that the existing substandard geometry of Summer/Main and Pembroke/ Main/Evergreen, in particular, is a major factor in their high accident experience.

19d. Future Growth Assumptions

The principal projects likely to affect this location, in addition to the Old Colony Rail Project, include the proposed Pyramid Mall site on Smith Lane in South Kingston. This would be a 500,000 sq. ft. shopping center, with access to local streets via an extension of Smith Lane, and direct southbound access to Route 3 via relocation of the existing SB ramps at the Smith Lane interchange. This development was estimated by the developers to generate 900 inbound and 900 outbound trips in the PM Peak Hour. Most of these trips, the developers assume, will use Route 3 in both directions for access, and will not directly impact local streets.

Other development projects pending in Kingston include a retail mall on Route 3A next to Kingsbury Plaza (square footage unknown), plus a number of small residential developments, primarily south and west of the railroad right-of-way (on Wapping Road, Elm Street, and Indian Pond Road).

Assumed Year 2000 base traffic volumes, based on an areawide growth factor of 1 percent per year, were computed and are presented in Figure 19-2.

Roadway improvements for the Route 3A corridor and the Pembroke/Main/Evergreen Street intersection have been sought for some time, with the expectation that Urban Systems or Chapter 90 funds would be used for construction. The developers of the Pyramid project have recently negotiated with the Town of Kingston to provide off-site roadway improvements at these locations, roadway widening, restriping and signalization at the intersections of Summer/Main Street and Pembroke/Main/Evergreen Streets.

Both these intersections were also analyzed as signalized intersections, assuming Year 2000 Base Volumes.

19e. Grade Crossings

Of the two grade crossings in this segment, Lake Street and Summer Street, only the latter needs improvement beyond the normal crossing protection. The Route 3A (Summer Street) crossing is close to Evergreen Street. This crossing affects volumes on Route 3A as well as on Evergreen and Pottle Streets. It will be equipped with full signalized gate controls as a project component. In addition, it is proposed that traffic signals with railroad pre-emption be installed as a mitigation measure here.

This crossing will be closed by commuter trains 3 times during morning and evening peak hours, given the schedule as proposed. A maximum gate closure of about 90 seconds is assumed for each train passby at this location. Average and 95th percentile queues at the grade crossing for Year 2000 conditions, based on arrival rates at the intersection during a 90-second passby event, are as shown in Table 19-2.

It is assumed that traffic signal pre-emption clears the SB Summer Street approach upon activation, stopping Evergreen Street. Evergreen Street will then remain stopped until after the gates lift and the through NB and SB moves on Summer Street have been given the first priority to move. Thus the average delays experienced by stopped vehicles on both streets in the PM Peak Hour are:

Summer NB	half the gate closure time + discharge time for median stopped vehicle (2 seconds X median queue)	= 45 sec. plus 9 sec. (or 54 sec.)
Evergreen EB (left turns)	half gate closure time + 1 Summer St. green phase + discharge time for Evergreen queue (2 seconds X median queue)	= 45 sec. plus 30 sec. plus 5 sec. (or 80 sec.)
Summer SB	half gate closure time + discharge time, median stopped vehicle (2 seconds X median queue)	= 45 sec. plus 21 sec. (or 66 sec.)

There are no major intersecting streets on Evergreen to be blocked by vehicle queues; so that although vehicles on Evergreen will experience delays, queue storage here can be handled without any difficulty. On Summer Street, the closest cross-streets to the north are Pottle Street, adjacent to the tracks, and Maple Street, 500 feet away. To the south Green Street is also 500 feet away from the grade crossing. This suggests that Pottle Street will experience blockage with each passby, while Maple Street may experience short-duration blockage under "maximum likely" queuing conditions, and assuming vehicles queue only in a single lane. On average, however, this intersection will not be blocked as a result of train passbys, nor will Green Street even under maximum queuing conditions.

19f. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of full gate crossing controls at the Lake Street and Summer Street crossings.
- Traffic signal--installation of traffic signal at Summer/Evergreen Streets, including railroad pre-emption capability.
- Street improvements--channelization, striping at Summer/Evergreen Streets to provide left- and right- turn lanes on Summer NB and SB, plus separate left- and right-turn lanes on the Evergreen EB approach.
- Monitoring of progress of Pyramid Mall-related improvements at Summer/Main and Pembroke/Main/ Evergreen.

Two alternative conceptual plans for the Summer and Evergreen Streets improvement are shown in the DEIS, Chapter IX, Figures IX-C18a and IX-C18b.

TABLE 19-1

Accident Data
Kingston Station Area Intersections

Intersection	Number of Reported Accidents 1986
Summer/Pottle	2
Summer/Evergreen	7
Summer/Main	32
Pembroke/Main/Evergreen	19
Evergreen (general)	3
Pembroke/Grove	3
Pembroke/Brookdale	2
TOTAL	68

TABLE 19-2

Queuing Analysis: Summer Street Grade Crossing, Kingston

	Year 2000 Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)
AM Peak Hour				
Summer NB--through	287	7	12	265
Evergreen EB--left	170	4	8	175
Summer SB	407	10	15	330
PM Peak Hour				
Summer NB--through	349	9	14	310
Evergreen EB--left	190	5	9	200
Summer SB	818	21	26	570

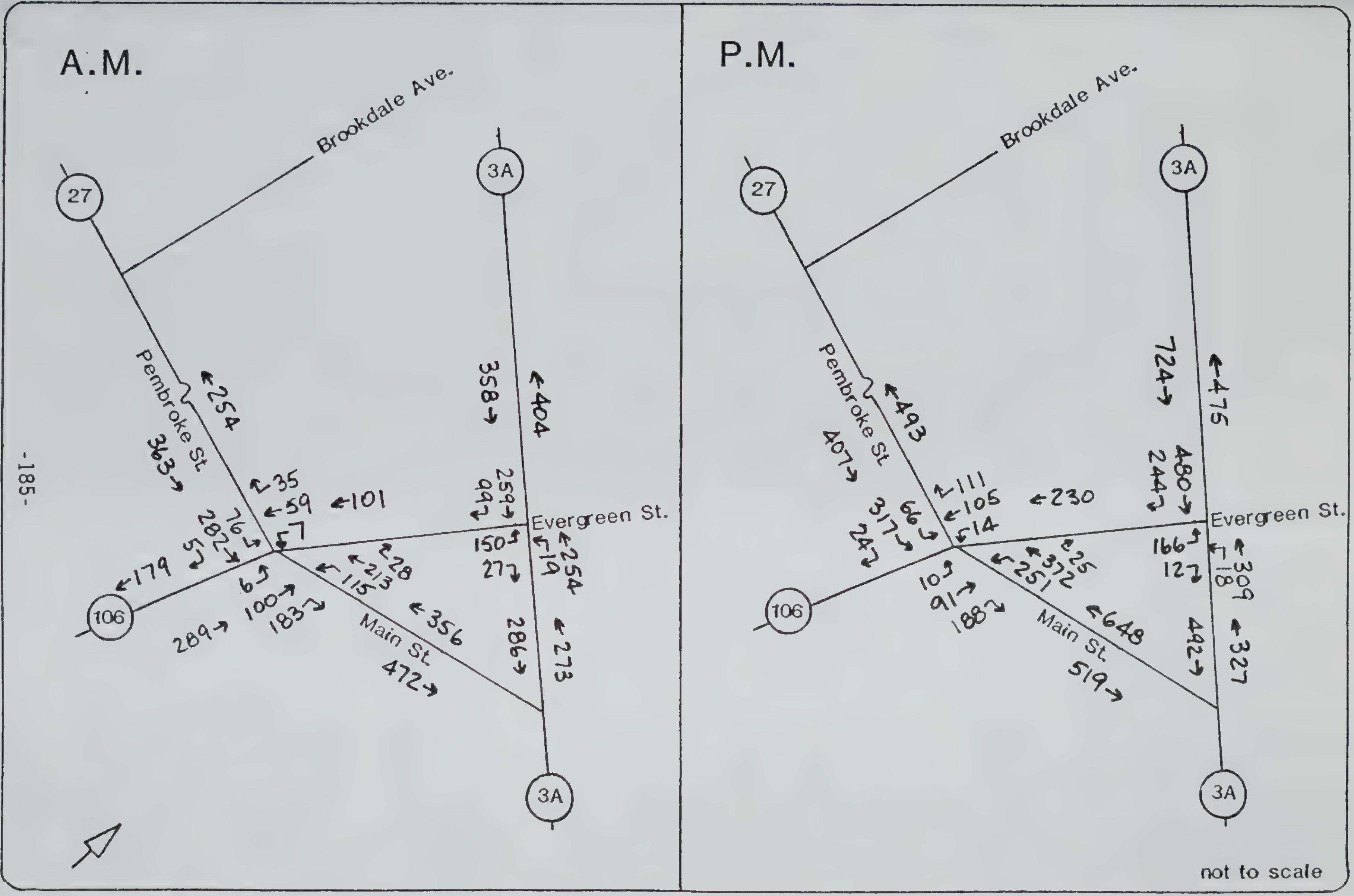

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FIG. 19-1
PLYMOUTH: Kingston
EXISTING TRAFFIC

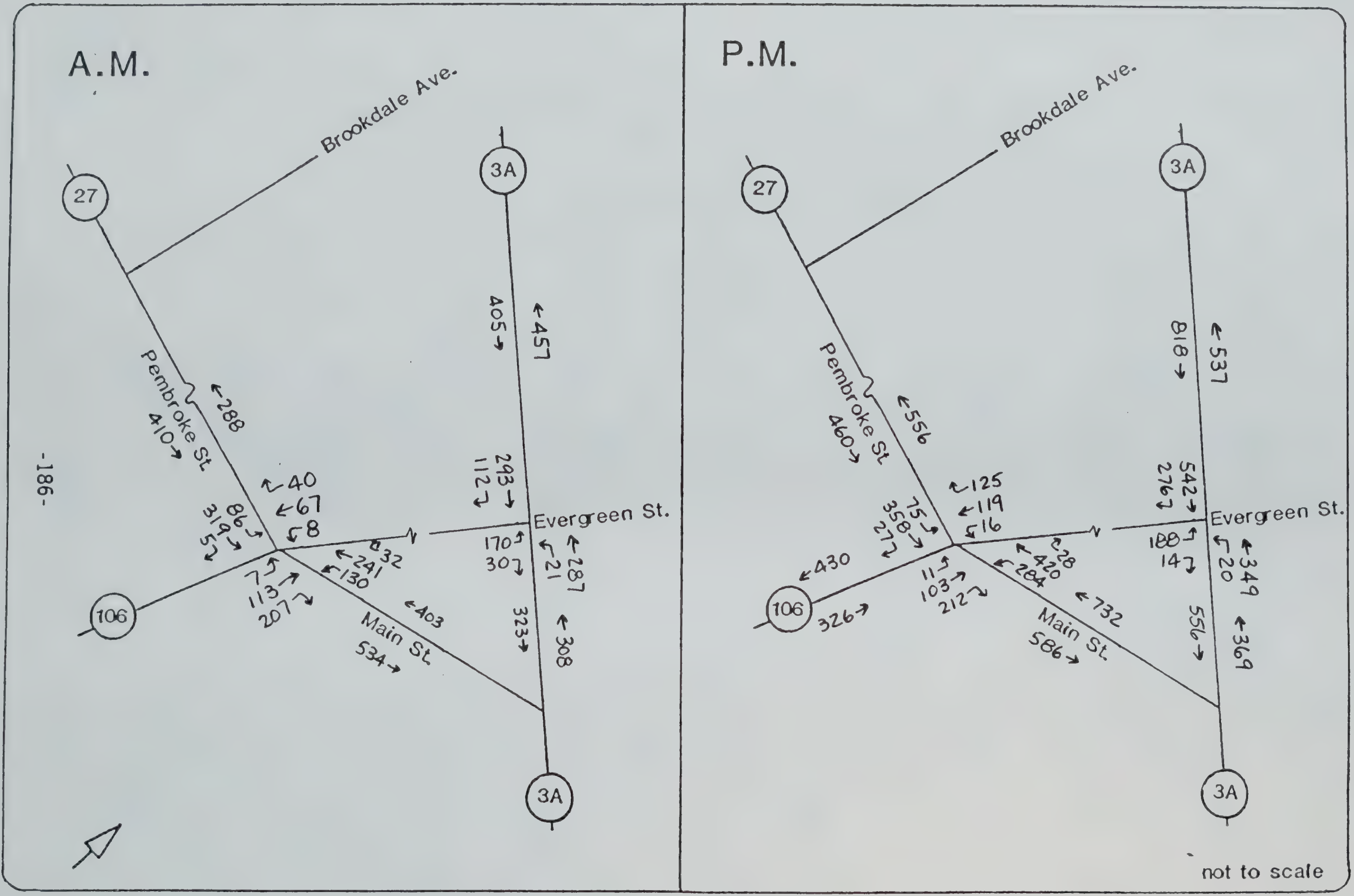

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FIG. 19-2
PLYMOUTH: Kingston
YEAR 2000 BASE TRAFFIC

20. Route 3/3A Station and Line Segment from the Jones River Crossing to Kingston-Plymouth Line

This segment extends from the Jones River to the Kingston-Plymouth Town Line, on the Plymouth Branch. A major station is proposed for a site located adjacent to Route 3 at its interchange with Route 3A, currently occupied by a warehouse/distribution facility owned by L. Knife and Sons.

In addition, two grade crossings are included in this section, at Foundry Lane and Boundary Street.

A station at the L. Knife site would be designed with direct ramp access to and from Route 3 in all directions. Consequently, the primary traffic impact within this section would occur on the newly-constructed ramps, with little added impact to Route 3A or local streets.

20a. Streets and Intersections

The principal roadways serving the area of the proposed station are Route 3 and Route 3A. Route 3 is the principal expressway facility connecting the South Shore with the Metropolitan Boston region. Route 3A is a major arterial which traverses the coastal areas of the South Shore, serving partly as a collector roadway providing access to Route 3, and also as a line-haul facility which carries trips as far as Neponset Circle on the route to Boston.

The primary reason for siting a station at this location is to take advantage of the close proximity of the rail line to Route 3, which can provide access to commuter rail parking for commuters from points in and south of Plymouth, including Cape Cod. Route 3 extends from the Southeast Expressway/Route 128 (I-93/I-95) merge in Braintree to the Cape Cod Canal. The road has three travel lanes in each direction between the I-93/I-95 merge and the Weymouth-Hingham Town line; and two lanes in each direction from Hingham southward to the Canal.

Environmental studies to widen the section between the current lane drop just south of the Route 18 interchange in Weymouth, and a point north of the Route 14 interchange (Exit 11) in Duxbury from four to six lanes are nearing completion. Widening of Route 3 south of the South River in Duxbury is a long-term objective of the Massachusetts Department of Public Works, with a time horizon on the order of 10 years; but planning has not yet begun on this project.

The existing ramps connecting Route 3 with Route 3A are of substandard design, with inadequate turning radii and lengths to accommodate exiting traffic. This is particularly true because the congestion on Route 3A, and lack of traffic control at the ramp termini (other than stop/yield signs) frequently cause vehicle queues to back up, particularly on the northbound Route 3 off-ramp.

Route 3A in this section is a 2-lane arterial with frequent curb cuts and intersections, including several intersections with numbered routes north of its interchange with Route 3. Route 3A in Kingston and Plymouth was the focus of a corridor study, performed by the Old Colony Planning Council (OCPC) in June 1987, which examined congestion and safety issues in the section between the

Kingsbury Shopping Plaza at Route 3A and 53, and the Kingston-Plymouth town line. Generally, this section is characterized by heavy volumes, slow traffic movement, and a relatively high incidence of accidents, attributable to the combination of high volumes and substandard geometry and control.

Other streets in the area serve primarily to provide residential access. The L. Knife warehouse is itself accessible only via Spring Street and Elder Avenue, both local residential streets.

20b. Existing Volumes

Peak period turning movement traffic counts were performed in 1986 and 1987 at the intersections of Route 3A with the Route 3 ramps and with Spring Street. As part of these counts, heavy truck movements on Route 3A and turning onto and off the Route 3 ramps were also observed. The majority of heavy trucks were marked with beer brand names, and so were presumed to be going to or coming from the L. Knife warehouse.

Traffic counts were adjusted and balanced to produce Existing Traffic Volumes, as shown in Figure 20-1. Existing volumes are not strongly directional: Route 3 itself is the major attractor of traffic in both directions. Traffic congestion and forced-flow conditions were observed at both Route 3 ramp intersections with Route 3A, particularly in the PM Peak Hour. Congestion on Route 3A close to the Route 3 ramps is exacerbated by backups from points farther north, at the Route 3A intersections with Routes 80 and 106. At these intersections, through northbound traffic on Route 3A is blocked by left-turning vehicles waiting for gaps in the southbound flow.

Level of Service analysis was applied to existing traffic volumes using the existing roadway/ramp configuration, as illustrated schematically in Figure 20-1, and current traffic control. The results are summarized in Table 20-1.

It is our understanding that the private developer of a shopping center, to be located close to the Smith Lane interchange of Route 3, has included signalization of the Route 3/3A ramps, as well as the intersections of Route 3A with Routes 80 and 106, as part of the shopping center traffic mitigation. Such signals have been approved in principle by the Mass. Department of Public Works; they, together with other proposed roadway improvements, are currently being designed by the developer's engineers.

20c. Accident Data

A detailed traffic accident analysis based on 1983 and 1985 data was included in the OCPC Corridor Study of Route 3A at this location. This analysis indicated that the corridor generally has higher-than-average accident incidence. The section between Hilltop Avenue and Spring Street, which includes the Route 3A ramp termini, several restaurant curb cuts (including the Howard Johnson restaurant and motel), several closely-spaced residential streets on the south side of 3A, shows the highest accident incidence of all (23 accidents per million vehicle-miles of travel!). The greatest accident types observed in this section were angle collisions involving a minor-street vehicle entering through traffic, and rear-end collisions within the through traffic flow.

As part of the present study, this information was updated to include 1986 accident totals at key locations. The resulting accident totals are summarized below:

Location	1986 Number of Accidents
Route 3A at:	
Hilltop Ave.	2
Howard Johnson Driveway/ SB on-off ramps	10
Home Park Court/ NB on-off ramps	5
Spring St./Pleasant St.	2
Segment between NB and SB ramps	15
Segment between NB ramps and Spring St.	22

20d. Future Growth Assumptions

The principal pending development project in this area is the Independence Mall in Kingston, a 500,000 sq. ft. shopping center currently under construction on a parcel of land accessible from Smith Lane just east of the interchange connecting Smith Lane with Route 3. This is the next interchange south of the Route 3A interchange, where the proposed railroad station would be located.

A traffic study of the proposed shopping center was performed in 1987. The assumed distribution of generated traffic was 95 percent to/from Route 3 via the Smith Lane interchange, with the remaining 5 percent using Route 3A for access. The Route 3A component amounts to an increase over base levels of about 18-20 vehicles in the Peak Hour in the northerly direction (i.e., toward the proposed railroad station).

No explicit analysis of intersections close to the Route 3/3A interchange was performed for the Independence Mall study; but commitments for improvements, including minor widening, restriping and/or signalization, were included at several locations:

- Route 3/Route 3A
- Route 3A/Route 106
- Route 3A/Route 80

Background traffic was assumed to grow at a rate of 1 percent per year uncompounded to Year 2000 in the vicinity of the Route 3/3A intersection, partly on the basis of limited existing roadway capacity which limits potential traffic growth.

The resulting Base Traffic condition is displayed in Figure 20-2, Year 2000 Traffic, on line diagrams which assume the existing ramp scheme unchanged.

Level of Service analysis was applied at critical intersection locations for this future Base Traffic case. The results are displayed in Table 20-1. The LOS procedures do not accurately reflect queue conflicts and backups. They primarily reflect the efficiency of traffic signal processing. Still, signalization of the ramps would probably relieve some of the accident problems currently observed at the Route 3 NB and SB ramp termini on Route 3A.

20e. Station Traffic

A Route 3 railroad station would be located on the site of the existing L. Knife beer warehouse, with access via a ramping scheme which connects the station parking lot directly with Route 3 for all travel movements as shown in Chapter IX of the DEIS, Figure IX-B13. The ramp scheme would also provide improved connections for general traffic between Route 3 Northbound and Route 3A, by eliminating the substandard lengths and turning radii of the existing ramp. The overall circulation changes include:

- New frontage roads on both sides of Route 3.
- A slight shift in the alignment of Route 3 itself.
- Widening of the Route 3A bridge over Route 3 to provide a 4 lane cross-section.

These improvements are considered an integral part of a Route 3 station. Consequently, the analysis of traffic operations with a railroad station assumes these mitigation measures. Figure 20-3 redistributes the Base Traffic volumes of Figure 20-2 on this revised network.

The Route 3 station would attract regional traffic from points as far south as Cape Cod. Traffic analysis for this station assumes that commuter rail service is provided on the Middleborough and Plymouth lines only, since this is the alternative for which the greatest demand is generated. The assumed sources and access routes of traffic to a station at this location are summarized below.

Origin	AM Peak Hour Arriving/Departing Vehicles		Primary Access Route
Carver	14	2	Rt. 3 NB
Cape Cod	100	14	Rt. 3 NB
Duxbury	134	38	Rt. 3 or 3A SB
Kingston	11	4	Rt. 3A SB
Marshfield	39	5	Rt. 3 or 3A SB
Plymouth	103	28	Rt. 3 or 3A NB
Wareham	2	0	Rt. 3 NB
	403 in	91 out	

To be conservative, all station volumes were assumed to be net additions to existing traffic. None are assumed to represent local traffic already using local streets.

Figure 20-4 illustrates the distribution of these station volumes on a revised network which includes the proposed access ramp system; while Figure 20-5 represents Total Future (Year 2000) traffic, including both base traffic and station volumes.

Because the proposed ramp scheme keeps station traffic off local streets, total Year 2000 traffic volumes with a commuter rail station represent increases above Base volumes of 1.5-2.5 percent on Route 3A.

Level of Service analysis applied to the intersections of the Route 3 ramps and Route 3A was undertaken, assuming future volumes (with station), signalization, and a widened Route 3A bridge over Route 3. The results are summarized in Table 20-1.

Essentially, the project represents a net benefit to traffic operations on Route 3A in this area, for several reasons:

- It corrects existing roadway deficiencies, by widening the Route 3A bridge to provide sufficient through and left-turn capacity in both directions so that lengthy queuing is avoided and by rebuilding the existing substandard Route 3 NB off-ramp to meet current geometric requirements.
- It takes heavy truck traffic off Spring Street and the other residential streets which currently provide access to L. Knife.
- It adds minimal traffic volumes to Route 3A, consisting mainly of local vehicles from Kingston neighborhoods south of this interchange. It is, in fact, most likely that these are not "added vehicles", as assumed here, but rather, vehicles currently using Route 3A in this location to access Route 3 for trips to Boston.

20f. Grade Crossings

The grade crossings in this section are located at Foundry Lane and Boundary Street, both located close to the Kingston/Plymouth Line.

Foundry Lane currently provides access to approximately 9-10 houses along the beach in Kingston. These houses also have access to Route 3A via Gray's Beach Lane and Howlands Lane, which has a bridge over the track. Consequently, impacts to traffic from grade crossing closures at Foundry Lane are extremely minimal.

Boundary Street provides access to several industrial buildings which are owned by Salt Water Trust. The Boundary Street crossing involves a spur track which provides rail access to loading platforms serving these buildings. A parking lot with approximately 75 spaces is located adjacent to the crossing, and additional parking area is provided at the truck loading docks on the water side of the industrial buildings.

Here, too, the low volume of traffic likely to use this crossing in any peak hour reduces the magnitude of traffic impact. Vehicles approaching or leaving the industrial buildings will experience brief delays associated with railroad crossing closures. The track is approximately 280 feet from Route 3A; if all 75 parking-space vehicles arrived in the peak AM 15 minutes, the average vehicle queue per grade crossing closure (90 seconds) would involve 5 queued vehicles (110 feet), and the "maximum likely" queue (about 9 vehicles) would extend less than 200 feet. Consequently, the grade crossing impact here is judged to be minimal.

20g. Mitigation Measures

The following traffic measures are recommended:

- Widening of Route 3A bridge over Route 3, and construction of new ramps providing all connections between Route 3 Northbound, Route 3A, and the proposed railroad station. This will incorporate relocation of Route 3 by up to 100 feet, and construction of a tunnel under Route 3 to accommodate a Southbound Route 3 on and off connections to the station. Conceptual plans for these ramps are shown in Chapter IX of the DEIS, Figure IX-B13. (NOTE: Any such redesign is subject to the approval of the Massachusetts Department of Public Works). Coordination with developer proposing to signalize the Route 3 ramp termini at this location.

- Grade crossing controls--installation of full gate controls at the Foundry Lane and Boundary Road grade crossings.

TABLE 20-1

Route 3/3A Ramp Termini Level of Service Analysis

Existing (1987) Unsignalized				
Left turn in	A(513)	A(408)	A(591)	B(399)
Left turn out	E(6)	F(-39)	E(23)	F(-37)
Right turn out	A(855)	A(720)	A(787)	B(385)
Year 2000 Base Unsignalized				
Left turn in	A(495)	B(361)	A(574)	B(303)
Left turn out	F(-59)	F(-31)	F(-31)	F(-66)
Right turn out	A(813)	A(694)	A(573)	C(274)
Year 2000 Base Signalized	C(23.5)	D(25.3)	B(8.5.)	C(15.6)
Future with Station Signalized (2-lane Approaches on Rt. 3A)	B(7.2)	B(6.8)	B(8.9)	C(15.7)

NOTE: Numbers shown after unsignalized intersection LOS values indicate "available reserve"--higher numbers indicate superior LOS. (i.e., >400 is LOS A, <100 is LOS E, <0 is LOS F).

Numbers shown after signalized intersection LOS values indicate overall intersection delay in seconds--lower numbers indicate superior LOS (i.e., <5 seconds is LOS A, >30 seconds is LOS E).

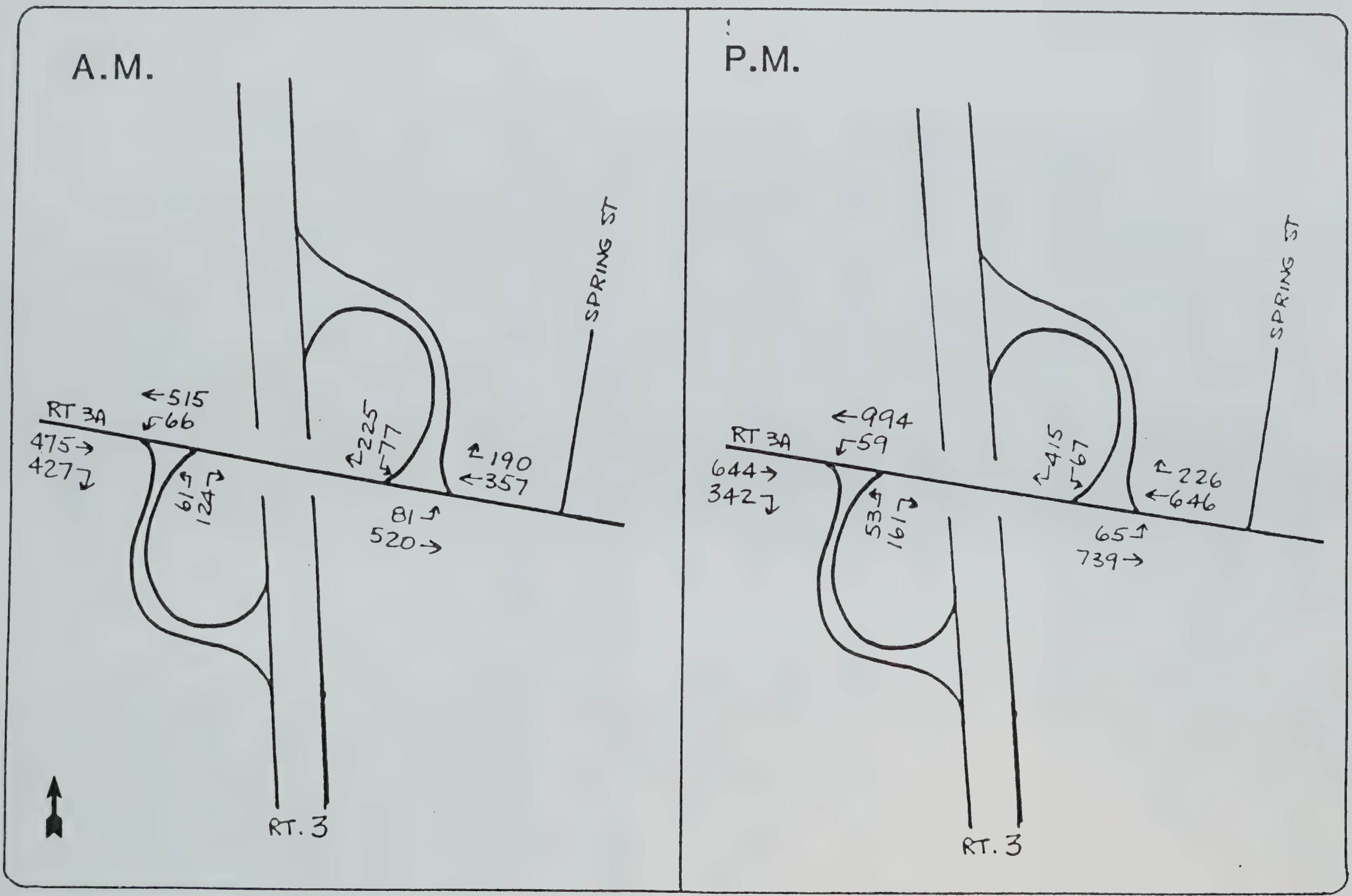

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Fig. 20-1
Route 3 Station
Existing (1987) Traffic

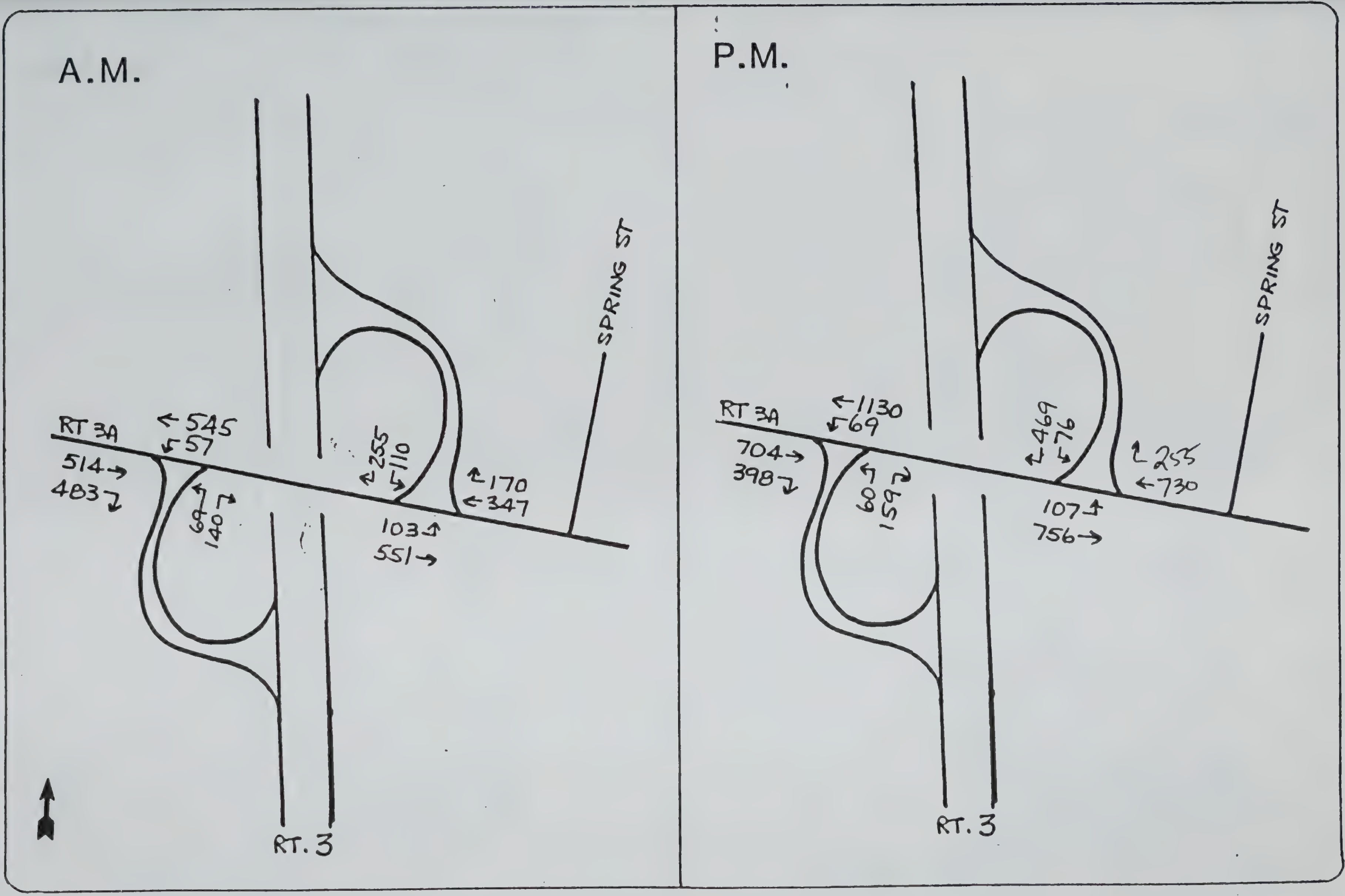

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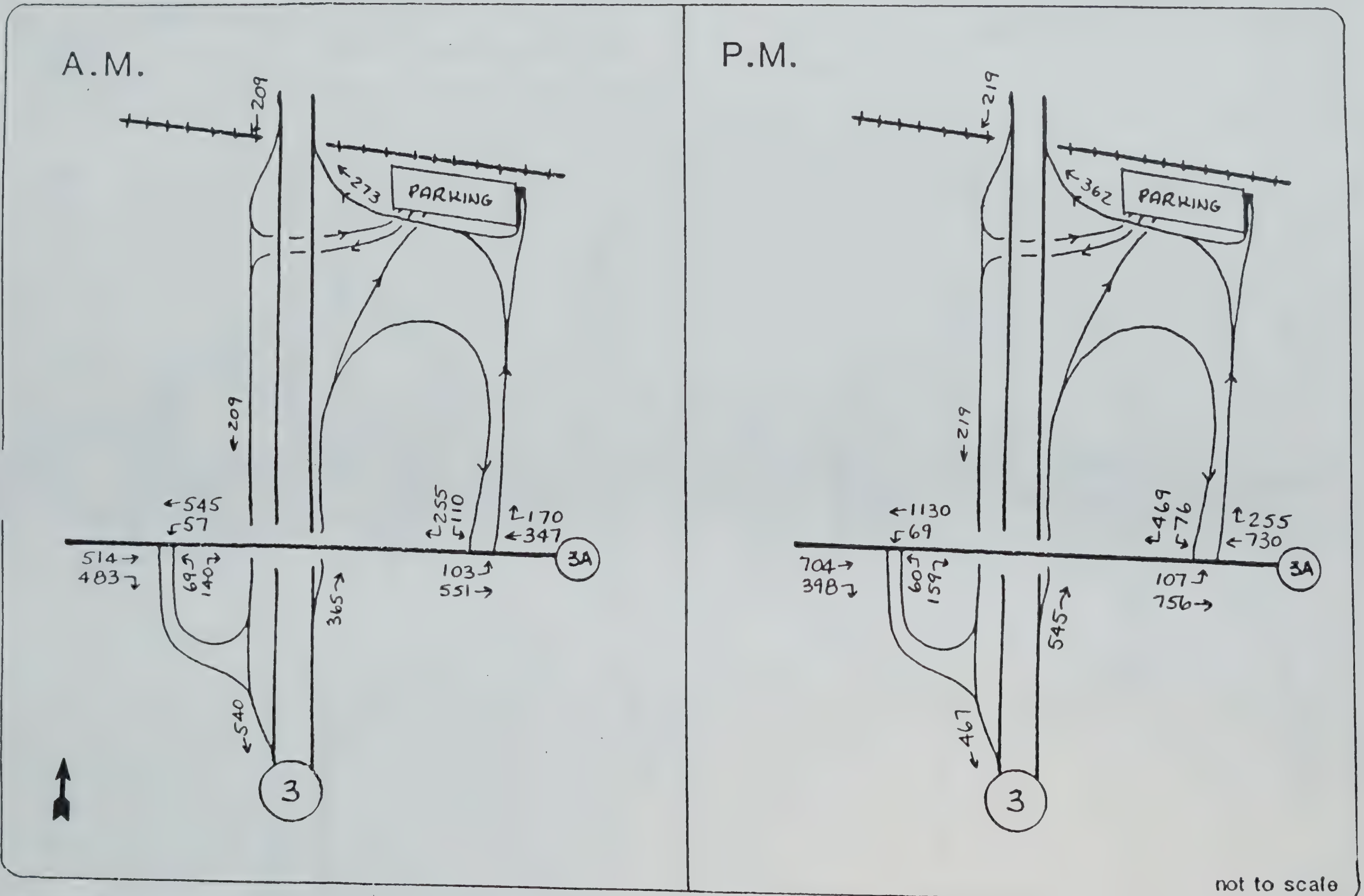
Fig. 20-2
Route 3 Station
Year 2000 Base Traffic



not to scale

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FIGURE 20-3
ROUTE 3: ROUTE 3
YEAR 2000 BASE TRAFFIC (ON PROPOSED NETWORK)

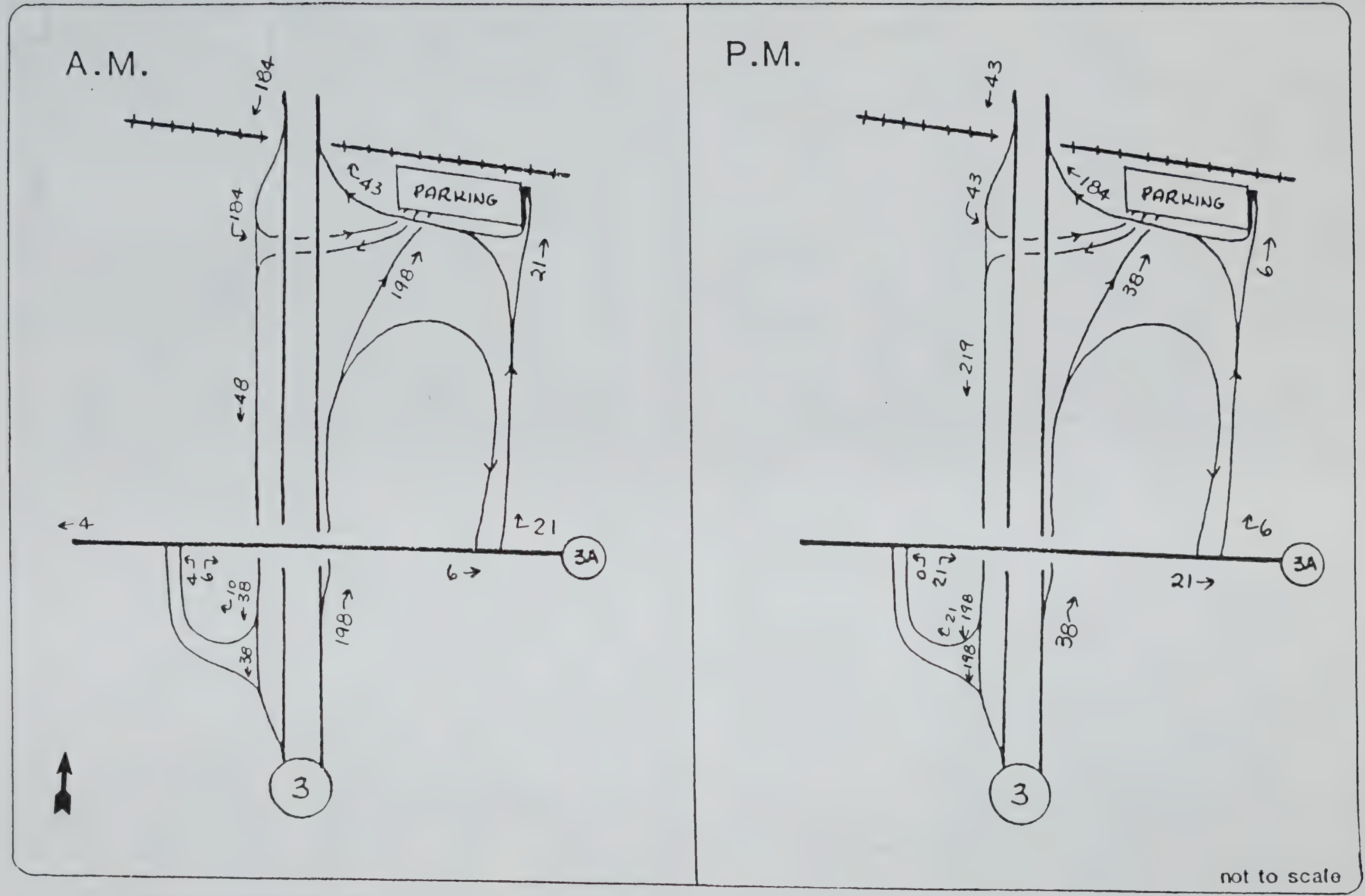

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FIGURE 20-4
PLYMOUTH: Route 3
STATION TRAFFIC

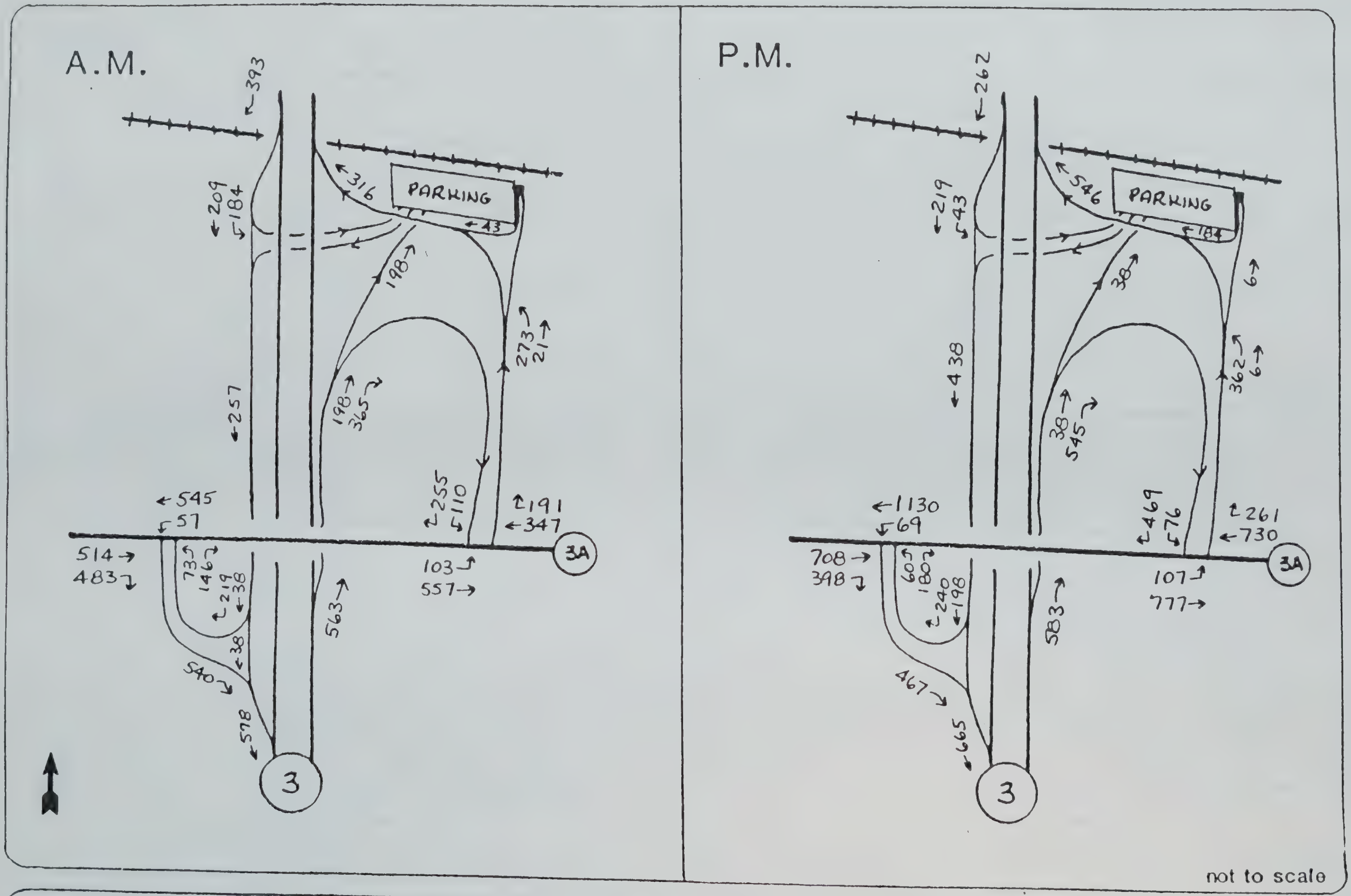

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FIGURE 20-5
PLYMOUTH: ROUTE 3
TOTAL FUTURE TRAFFIC

21. Plymouth Station and Line Segment from Kingston-Plymouth Line to Hedge Road, Plymouth

This segment extends from the Kingston-Plymouth Town Line to Hedge Road, south of Cordage Park in Plymouth. It includes the last proposed station location on the Plymouth Line. This section contains two private crossings, one within Cordage Park and one at Hedge Road, close to the proposed station location in the southwest quadrant of the roadway/grade crossing. Street traffic impacts would result from station operations, with grade delays only to traffic generated by the station itself, or by any added development at this end of Hedge Road.

The analysis of this line segment and station was performed under the assumption that a major Route 3/Kingston Station will be constructed, with a large parking facility designed to intercept Route 3 traffic from south of Plymouth. The Plymouth station itself is intended to serve mainly North Plymouth residents.

21a. Streets and Intersections

Hedge Road is a two-lane, residential street which ends in a cul-de-sac at Plymouth Harbor. The street provides only local access to abutting land uses, which include storage space for the Town of Plymouth school buses. Consequently, existing traffic volumes on the street are very low, characteristic of a development driveway rather than a city street. It intersects Court Street (Route 3A) approximately 1,100 feet from the proposed station location.

Court Street (Route 3A) in this section operates as an urban street, with one travel lane in each direction. There is a long-standing project to widen the street south of Hedge Road; but local opposition to widening of Court Street to a standard cross-section has delayed improvements here. The Town is currently planning to add turning lanes and increase turning radii at the Court/Hedge Road and Court/Cherry Street intersections. This project is expected to be completed by 1992. North of Hedge Road, Court Street widens, and travel speeds increase to 30-35 mph.

At the Cordage Park entrance, a SB left-turn lane and a NB right-turn deceleration lane have recently been added to facilitate the flow of traffic on Court Street.

Existing Route 44 is an east-west roadway which ends as a 2-lane street connecting downtown Plymouth with Route 3, over a mile south of Hedge Road. A long-standing plan to relocate and upgrade Route 44 would include circulation changes in the northern section of Court Street, close to Hedge Road.

Specifically, Route 44 would be relocated northward, to join Route 3 in the vicinity of Cherry Street. The existing Route 3/Cherry Street interchange would be rebuilt to eliminate direct connections between the Route 44/Route 3 interchange and residential Cherry Street. Such an arrangement would not eliminate the connection between Cherry Street and the 2 highways entirely, but would require vehicles desiring to make these connections to do some circuitous driving.

The intent is to discourage the use of Cherry Street as a primary access route to relocated Route 44 and Route 3. In addition, such routing will discourage use of a Hedge Road station by Route 3 or Route 44 long-distance traffic. Such commuters will be directed to the Route 3/3A station in Kingston.

21b. Existing Volumes

Peak Hour turning movement traffic counts were obtained at the intersection of Hedge Road/Court Street, and estimates of Cherry Street/Court Street volumes were made from data in the Route 44 EIS. Balanced traffic volumes for 1987 are presented in Figure 21-1.

21c. Accident Experience

Town of Plymouth Police Records were consulted to obtain accident data at intersections near the proposed commuter rail station. The List below summarizes the reported accidents at those intersections for 1986.

Location	Reported Number of Accidents 1986
- Court St./Hedge Rd.	2
- Court St./Cordage Park	6
- Court St. (general)	3

These numbers do not appear unusual or problematic. Roadway improvements recently completed at the entrance to Cordage Park should reduce the accident experience at that location in any event.

21d. Future Growth Assumptions

No specific local development projects were included in the growth forecasts for this area. However, the area is expected to experience greater-than-average growth over the next twenty years. For purposes of this analysis, assumed Year 2000 Base Traffic volumes, based on an areawide growth factor of 1 percent per year or 13 percent overall uncompounded, were computed and are presented in Figure 21-2.

From these growth levels, future Levels of Service (LOS) were calculated for the Hedge Road/Court Street intersection assuming continued unsignalized operation. The resulting LOS are presented in Table 21-1. No assumption was made about any additional development at the vacant parcels on Hedge Road; it was assumed that impacts caused by any such development will be dealt with by that developer.

For unsignalized intersections, LOS results are calculated separately for each critical move. Values of "E" for left turns from minor streets to major ones indicate the delays commonly experienced by those vehicles waiting for gaps in 2-way opposing traffic streams. Because queues will be short, this is acceptable at this location, as long as left- and right-turns out of Hedge Road have room to queue separately.

21e. Station Traffic

Patronage forecasts for a Plymouth station by mode of station access were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for Alternative 3b, Middleborough and Plymouth Line only, were used to determine peak hour vehicle attractions to the station. This forecast resulted in an estimate of 59 daily parkers and 30 drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals, or 35 parking vehaicles arriving AM, departing PM,and 18 drop-off vehicles entering and exiting the station in each peak hour. All station-generated traffic would have Plymouth origins, and most would access the station from the south, as shown in Figure 21-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Court Street or other streets.

The sum of Base Traffic and station traffic yields an estimate of Total Year 2000 traffic volumes as depicted in Figure 21-4. These future volumes represent increases above Base volumes of approximately 1 to 8 percent on Court Street, depending on location and time of day.

Level of Service results for the Court Street/Hedge Road intersection under future volume conditions are shown in Table 21-1.

21f. Grade Crossings

Because the only traffic impacted by the grade crossings under current assumptions is Cordage Park or other local station traffic, queuing assumptions here differ from those at crossings on through streets. It was assumed no queueing would occur and the traffic stopped by a train would be minimal.

There are no nearby intersections to be blocked. With full gates installed, vehicle-train conflicts will not occur. Average delay per stopped vehicle will be 45 seconds plus the start-up time for the median vehicle; or 8 seconds: a total of 53 seconds.

21g. Mitigation Measures

Grade Crossing Controls--installation of full gate crossing controls at the Hedge Road grade crossing.

TABLE 21-1

Level of Service Analysis
Plymouth Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service: Year 2000 Traffic without Plymouth Station AM	without Plymouth Station PM	with Plymouth Station AM	with Plymouth Station PM
Court/Hedge					
Left turn from Court into Hedge EB	NO	A	A	A	A
Left turn from Hedge into Court SB	NO	B	D	C	E
Right turn from Hedge into Court NB	NO	A	A	A	A

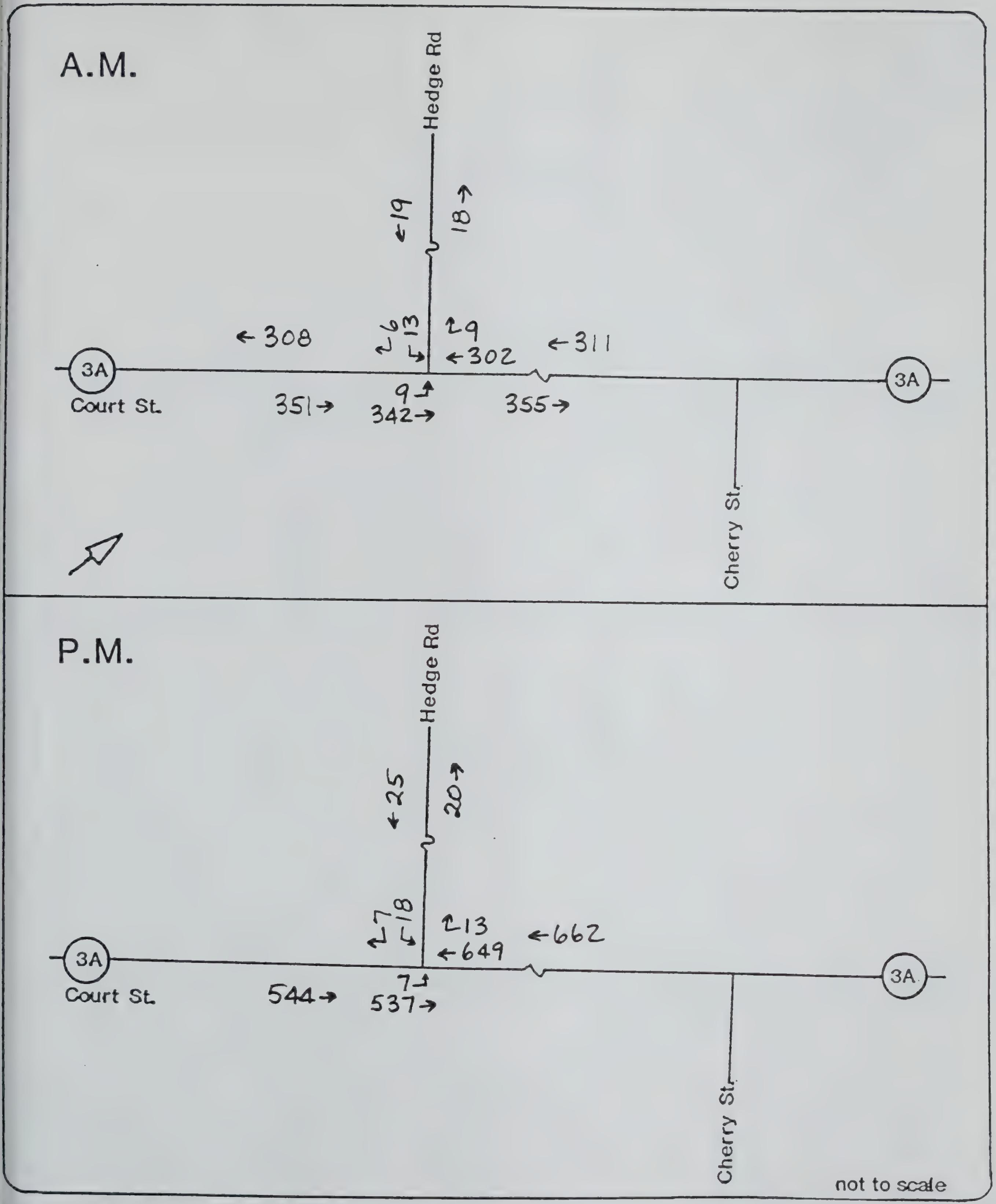

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FIG. 21-1
PLYMOUTH: Plymouth
Existing Traffic

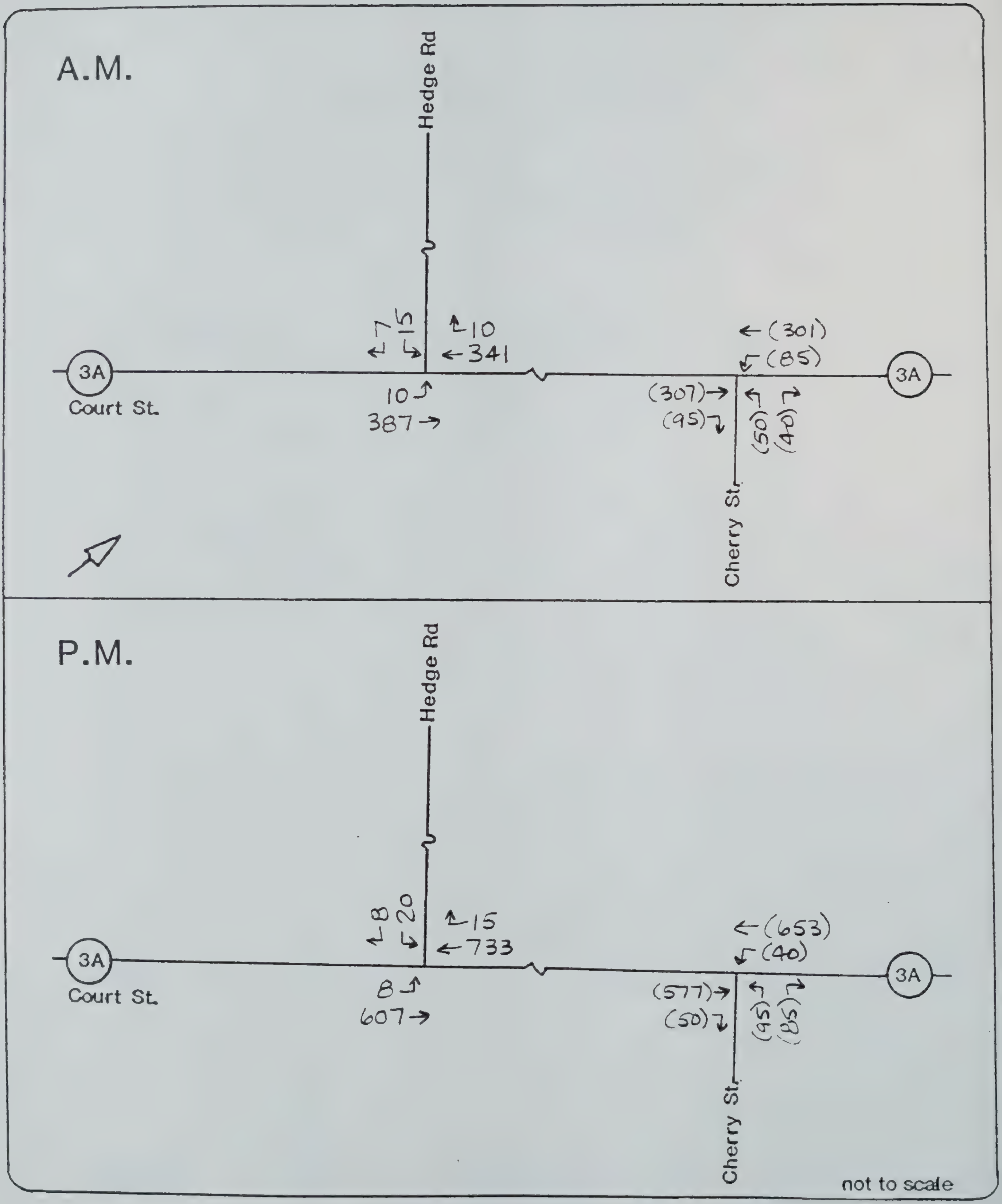

FIG. 21-2
PLYMOUTH: Plymouth
YEAR 2000 BASE TRAFFIC

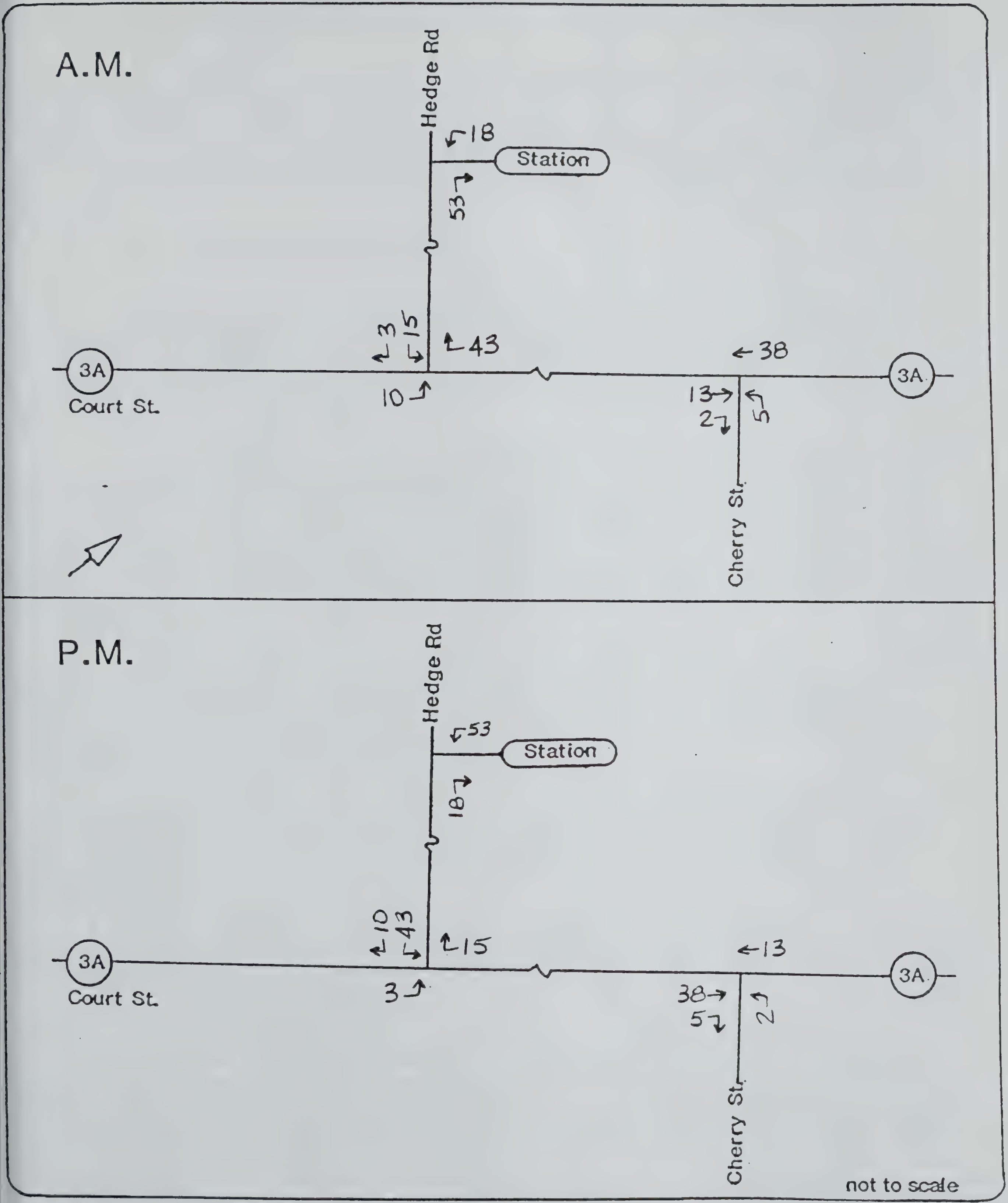

FIG. 21-3
PLYMOUTH: Plymouth Station Traffic

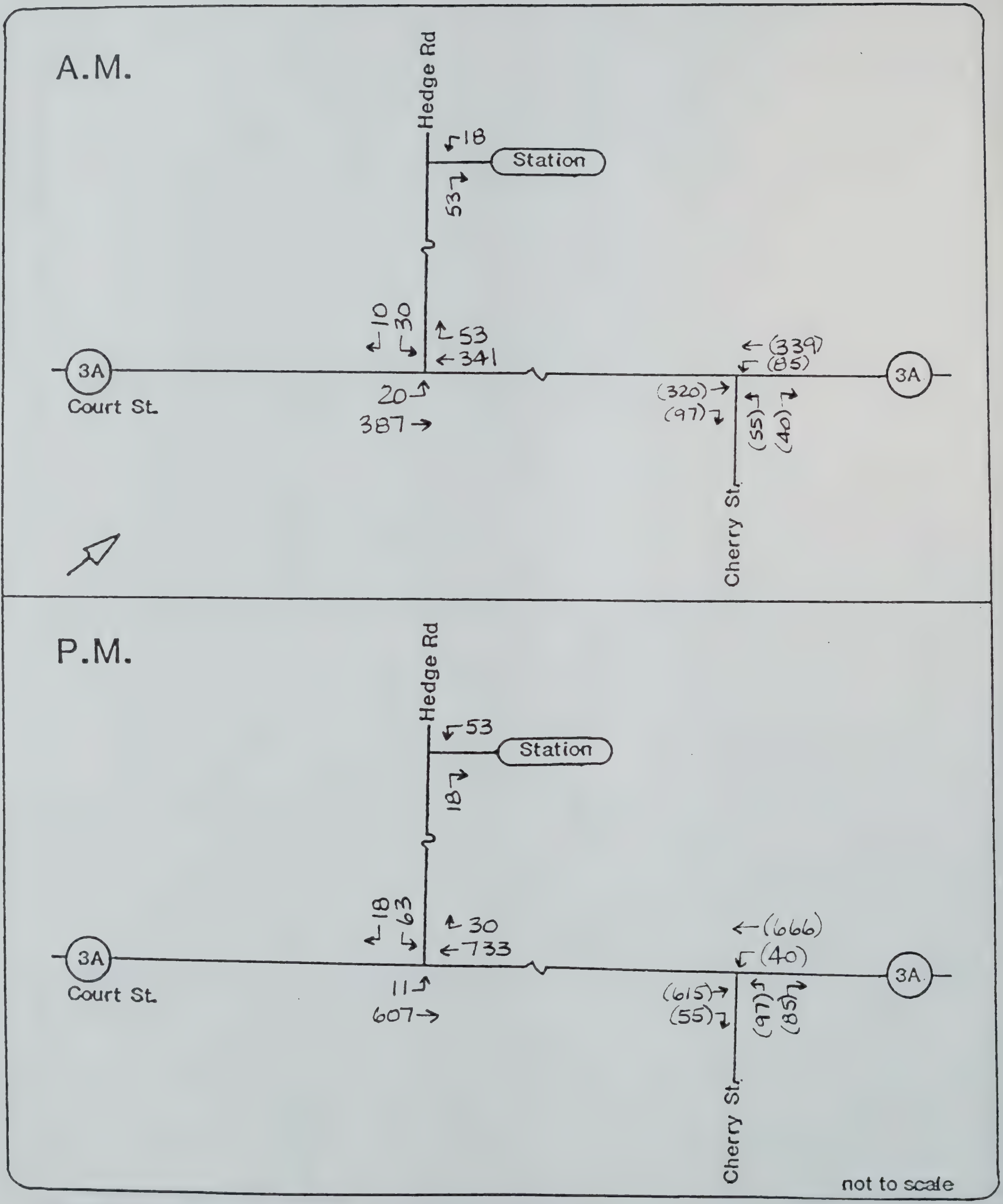

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FIG. 21-4
PLYMOUTH: Plymouth
Future Traffic, with Statio

22. Weymouth Landing Station and Line Segment from Braintree Wye to North Street, Weymouth

This segment extends from the Braintree Wye to North Street in Weymouth, on the Greenbush Branch. A proposed station site is included: Weymouth Landing station, located on Commercial Street east of Washington Street, with access from Commercial Street. This segment also includes six grade crossings in close proximity to one another: at Commercial/Front St., Front/Allen St., Shaw Street and Quincy Avenue in Braintree; and two crossings of Commercial Street in Weymouth.

22a. Streets and Intersections

The station site is located on Commercial Street, a principal east-west arterial street serving the northern part of Weymouth. Commercial Street begins in the Weymouth Landing business district at Washington Street, and proceeds eastward toward North Street. It is generally 1 wide travel lane in each direction, with sidewalks. Travel speeds on the street are generally about 30 mph.

Washington Street is designated Route 53 from its junction with Route 18 northward to the Weymouth Landing business district. Close to Weymouth Landing, it is an urban street, with two travel lanes plus parking in each direction and frequent intersections. The street was recently rebuilt as part of an Urban Systems project, jointly sponsored by the towns of Weymouth and Braintree. The primary objective of this project was to provide minor capacity increases through selective removal of on-street parking, minor widening and intersection improvements.

At major intersections, including Washington/Broad St. and Washington/Commercial St., there are multiple lanes which allow through traffic and left turns to queue separately. New traffic signals have been installed at both intersections. The net result has been a substantial improvement in operations through Weymouth Landing.

Quincy Avenue north of Union Street is the continuation of Route 53. It is 4 travel lanes wide in the area of the grade crossing, with sidewalks on both sides. Close to the grade crossing, a driveway through the rear of the Quirk Chevrolet parking lot provides a direct connection to Commercial Street in Weymouth.

Union Street is predominantly a residential street beyond the Landing, with approximately 50 feet of paved width.

22b. Existing Volumes

No pre-existing counts were available here in connection with the Urban Systems project currently under construction. New Peak Hour turning movement traffic counts were obtained at the intersections of Washington/Commercial/Front Streets and Washington/Quincy Ave/Union Street (January 1988). These counts are included in the Appendix. Figure 22-1 presents balanced existing traffic volumes derived from these counts.

Generally, traffic volumes in the Weymouth Landing business district are heavy during both peak hours, and are very strongly directional: 76 percent northbound on Washington Street west of Commercial in the AM Peak Hour, and 62 percent southbound in the PM Peak Hour. Traffic moves somewhat slowly through Weymouth Landing because of high volumes and delays at signals, and some local residents are reported to seek bypass routes using flanking residential streets, including Webb St. and Front St. Levels of Service at the Washington/Commercial St. intersection, previously in the D-E range, have been improved to B-C by the recent reconstruction.

22c. Accident Experience

Town of Weymouth Police Records were consulted to determine accident experience at intersections of concern near the proposed commuter rail station. Only information on absolute numbers of accidents at each location--not types of accidents-- was available to us. Recorded accidents for Calendar Year 1986 at these locations are summarized in Table 22-1:

To convert absolute numbers of accidents into accident rates at the critical locations, a rough estimate was made of the total annual vehicles entering the intersection, using the assumptions listed above. The statewide average accident rate for signalized intersections is 1.89 per million entering vehicles[1]. Using these estimates, both Broad/Washington and Commercial/Washington/Front exceed the statewide average.

The recent Urban Systems project in Weymouth Landing may reduce accident incidence here, if accidents reported in previous years resulted from vehicle conflicts due to lack of channelization or poorly-timed traffic signals; since these conditions have largely been repaired. Data from which such a judgment might be made are not yet available. Subsequent accident experience should be monitored to determine whether further improvements are required to improve safety.

22d. Future Growth Assumptions

The principal recent development projects in this area are located in Weymouth south of Commercial Street close to Route 18 and Route 3. These include a mix of commercial, office and residential development, oriented primarily towards Route 3 but also generating traffic increases in the Weymouth Landing area.

These include:

- Weymouth Square Shopping Center, at the junction of Routes 18 and 53--260,000 sq. ft. commercial plus 8- screen movie theater pending approval.

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[1] CTPS Technical Report 54a, Draft Route 9 Corridor Planning Study: Short-Range Element, January 1986.

- South Shore Electronics site, at junction of Routes 18 and 53--14,000 sq.ft. office supply store, in construction.

- B.J.'s Wholesale Warehouse, Route 53--104,000 sq.ft. warehouse/retail, open Summer 1987.

- Lechmere/Angelo's, Route 53--expansion to 94,500 sq.ft.--open.

- The Aerie--165-unit residential complex; received approvals.

The DEIR prepared for the Weymouth Square project included a 1988 traffic estimate which considered all these projects, including Weymouth Square itself. At the Washington/ Broad St. intersection, the sum of estimated 1988 entering volumes is 36 percent higher than 1986 existing volumes--a fairly abrupt and significant increase.

For purposes of the present analysis, assumed Year 2000 base traffic volumes were computed as follows:

- Growth along Washington Street due to the development projects cited above was assumed to increase 30 percent over counted volumes at Washington/Commercial St. for 1988--consistent with the anticipated development, but allowing for some local dispersion between Broad and Commercial Street.

- Additional traffic growth in the area was assumed to occur at an uncompounded rate of 1 percent per year between 1987 and 2000.

Future traffic estimates based on these assumptions were computed and are presented in Figure 22-2. Level of Service analysis was performed at key intersections. The results of this analysis are presented in Table 22-2 below.

The LOS analysis indicates that future operations at both Weymouth Landing intersections will be quite adequate, principally because of the recent improvements here.

The existing bypass of Washington Street, via the street which passes through the parking lot in back of Quirk Chevrolet, has heretofore been an attractive route for generally westbound traffic from Commercial Street. This route exits onto Quincy Avenue 85 feet south of the Quincy Avenue grade crossing. The recent improvements in the Landing may attract traffic away from this "short-cut"; nevertheless, some improvements should be made here at minimum to insure safety during grade crossings. In fact, the Town of Braintree may wish to consider closing off this route, as it is a public street under Town jurisdiction.

22e. Station Traffic

A commuter rail station on Commercial Street east of Weymouth Landing would be located on the former station site, in back of Quirk Chevrolet.

Daily boarding estimates for this station by mode of access were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, the alternative which results in the highest vehicle attractions to Weymouth Landing--that is Alternative 3c, Middleborough and Greenbush Lines only was assumed. Peak hour vehicle attractions to the station were estimated to represent 60 percent of total daily boardings. The resulting peak-hour arrivals include 123 patrons who park at the station, 68 drop-off patrons.

All rail patrons using this station would originate in Weymouth and Braintree. The assumed distribution of arrivals was based on direction of origin and observed population density within Weymouth. A large percentage of vehicles arriving from south of the station were assumed to turn off Washington Street and use local residential streets, such as Webb Street, as bypasses to reach the Commercial Street station location. The resulting distribution is shown in Figure 22-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic. None are assumed to represent local traffic already using Washington or other streets. In fact, however, it is more likely that some station-traffic, particularly Weymouth resident traffic, is traffic which would otherwise use local streets to access Quincy Ave., Route 18, Route 3, or an intermediate park-ride facility such as the Braintree Red Line station.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 22-4, represent increases above Base 2000 volumes of 1 to 18 percent, depending on location and time of day. Level-of-Service results for the Weymouth Landing intersections under future volume conditions are shown in Table 22-2.

As can be seen, operation of the station itself adds little to area traffic even under "worst-case" conditions (i.e., all newly-generated volumes). Operations will continue to be adequate, except that Commercial/ Washington/Front Street will drop from C to D in the PM Peak Hour. Otherwise, only slight increases in delays will be experienced by area traffic.

22f. Grade Crossings

The 6 grade crossings in this area are located within three-quarters of a mile of track in Braintree and Weymouth. The first 3 crossings--at Commercial/Front Streets, Front/Allen Streets, and Shaw Street in Braintree--are all located in neighborhoods which are essentially residential in character. At these locations, the streets crossed by the track carry mainly local residential traffic, so that volumes are not high, and, except for the Shaw Street crossing, there are no major signalized intersections nearby. The Shaw Street crossing is almost 300 feet from Union Street, the next major intersection. This should be ample to accommodate any vehicle queues that form here during a 90-second grade crossing closure.

Short vehicle queues at these locations will therefore cause delays, but will not represent a hazard. However, the Front/ Allen St. grade crossing is poorly designed at present, and would need to be realigned and channelized to provide safe approaches.

The more complex crossings are the 3 located on busy streets.

The Quincy Avenue (Route 53) crossing is located approximately 175 ft. from the Washington/Union/Quincy Ave. intersection, and would need to have railroad pre-emption installed in replacements for the new traffic signals. Quincy Avenue is 4 travel lanes wide at this location.

Neither of the 2 Commercial Street crossings is located close to a signalized intersection or other major street crossing. However, the more westerly crossing, close to the proposed station entrance, will be blocked by trains when they are stopped in the station; so that delays here will be longer than at other crossings on the line.

The traffic signal at Washington/Commercial is interconnected with the Commercial/ Union/Quincy Ave. signal. The former signal will not require railroad pre-emption, because interference by railroad crossing queues from either the Commercial Street or Quincy Avenue crossings will not be a problem here.

Gibbens and Webb Streets provide access to Webb Park and to nearby residences. Both intersect Commercial Street close to the more easterly grade crossing, and will themselves be subject to crossing delays as Commercial Street WB backs up. Gibbens in particular exits onto Commercial Street very close to the track and at an oblique angle. Residences using both these streets for access have alternative routes which can be used to bypass the grade crossings if necessary.

1) Queues at the Track

With Old Colony commuter service through this built-up area, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. At Commercial Street, where the train will need to block the track while stopped in the station, the maximum blockage time is estimated at 2 minutes. The proposed schedule calls for half-hour commuter- train headways on the Greenbush Line during peak hours, with less- frequent service during off-peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

Table 22-3 indicates average and maximum queue lengths likely to build up from the track during a train passby. The Commercial Street approaches are assumed to store queued vehicles in a single lane, while on Quincy Ave., 2 lane approaches are available in each direction. In the northbound direction, during morning peak hours, queues at the Quincy Avenue crossing will back part of the way down Washington Street, through the Weymouth Landing business district, but will not reach as far as Commercial Street.

With an assumed start-up delay time of 2 seconds per vehicle, the average delay per stopped vehicle will be as shown on Table 22-4.

2) Queues at Intersections

Similar reasoning was used to determine whether it is likely that normal queues forming at the Washington/Commercial/ Front St. traffic signals will back up as far as the westerly Commercial St. grade crossing. It is assumed that the signal pre-emption at Washington/Union/Quincy Ave. will handle clearance at that location.

The critical period at the Commercial Street approach is the AM Peak Hour, when the approach rate on Commercial WB is 13 vehicles per 60-second cycle period. The maximum or 95th percentile arrival rate is 18 vehicles per minute. Assuming that at least 30 percent of the green time is available to the Commercial Street move, however, a maximum of 70 percent of vehicles arriving during any minute are likely to be delayed at Washington Street; or 13 vehicles in a "maximum-arrival" minute. This represents a maximum queue length of 285 feet, which is well under the distance from Washington Street to the track.

22g. Driveway/Street Blockage

The primary streets/driveways which will experience short-term blockage during peak hours as a result of train- passby-related traffic queues include mainly residential driveways near the Commercial/Front St., Front/Allen St., and Shaw St. crossings. Business driveways along Quincy Ave. will also be temporarily blocked by traffic queues, including the Quirk Chevrolet driveways on both Commercial St. and Quincy Ave.

The route through Quirk Chevrolet which avoids Washington Street will also be blocked on the Quincy Avenue end. The MBTA may consider either entering into negotiations with the property owner to block off this roadway as a route for through traffic; or obtaining a right-of-way here and making this a formal route.

Gibbens and Webb Streets will also experience delays exiting onto Commercial Street, caused by standing queues of vehicles on that street. Alternate exits from the Webb Park neighborhood are available, and delays will be short-lived.

22h. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of grade crossing controls at all crossings equipped with gates, lights and bells.
- Traffic signal--replacement of existing signal controller, if necessary, to provide railroad pre- emption at Washington/Union/Quincy Ave.
- Street improvements--provision of left-turn storage lane at station

entrance on Commercial Street EB, and right-turn deceleration lane on WB approach.

- Improvements to/closing off of the public street behind Quirk Chevrolet, to be determined.

A conceptual plan for the improvements at Commercial Street and the station entrance is shown in the DEIS, Chapter IX, Figure IX-C19.

TABLE 22-1

Accident Incidence from Weymouth Police Records

Intersection	Number of Recorded Accidents 1986	1987**	Est. Rate*
Broad/Washington	11	16	3.5
Commercial/Front/Washington	18	9	2.6
Commercial/Ledge Hill Rd	0	1	--

*per million vehicles entering intersection. Assumptions: higher peak hour is 10 percent of AWDT, total annual entering vehicles is (300)(AWDT).

**through June.

TABLE 22-2

Level of Service Analysis
Weymouth Landing Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service:* Year 2000 Traffic without Commuter Rail Station AM	PM	with Commuter Rail Station AM	PM
Washington/Commercial/ Front St.	YES	B	C	B	D
Washington/Quincy Ave/ Union St.	YES	C	B	C	B

*revised January 1988 to account for completion of Urban Systems project and new traffic counts at Washington/Quincy Ave/Union Street.

TABLE 22-3

Queuing Analysis: Weymouth Landing Grade Crossings

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Dist. to Nearest Major Int. (ft.)
1. Quincy Ave.					
--NB appproach					
AM Peak Hour	1268	32	38	420*	175
PM Peak Hour	748	19	24	265*	175
--SB approach					
AM Peak Hour	587	15	20	220*	(none)
PM Peak Hour	1302	33	39	430*	(none)

*in 2 lanes

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Dist. to Nearest Major Int. (ft.)
2. Commercial St.(W)					
--EB approach					
AM Peak Hour	298	10**	15	330	860
PM Peak Hour	575	19**	25	550	860
--WB approach					
AM Peak Hour	795	27**	32	700	none
PM Peak Hour	353	12**	17	370	none

**2-minute arrival rate, for train stopped across street.

3. Commercial St.(E)

Same as, or less than, Commercial St.(W). Traffic on Gibbens and Webb Streets will also experience delays.

TABLE 22-4

Average Delay per Stopped Vehicle

	Avg.No. of Stopped Vehicles	Avg.Delay per stopped vehicle (sec.)	Avg.Total Stopped Delay per approach, (min.)
1. **Quincy Ave.**			
--NB appproach			
AM Peak Hour	32	77	41.1
PM Peak Hour	19	64	20.3
--SB approach			
AM Peak Hour	15	60	15.0
PM Peak Hour	33	78	42.9
2. **Commercial St.(W)**			
--EB approach			
AM Peak Hour	10	70	11.7
PM Peak Hour	19	79	25.0
--WB approach			
AM Peak Hour	27	92	41.4
PM Peak Hour	12	72	14.4

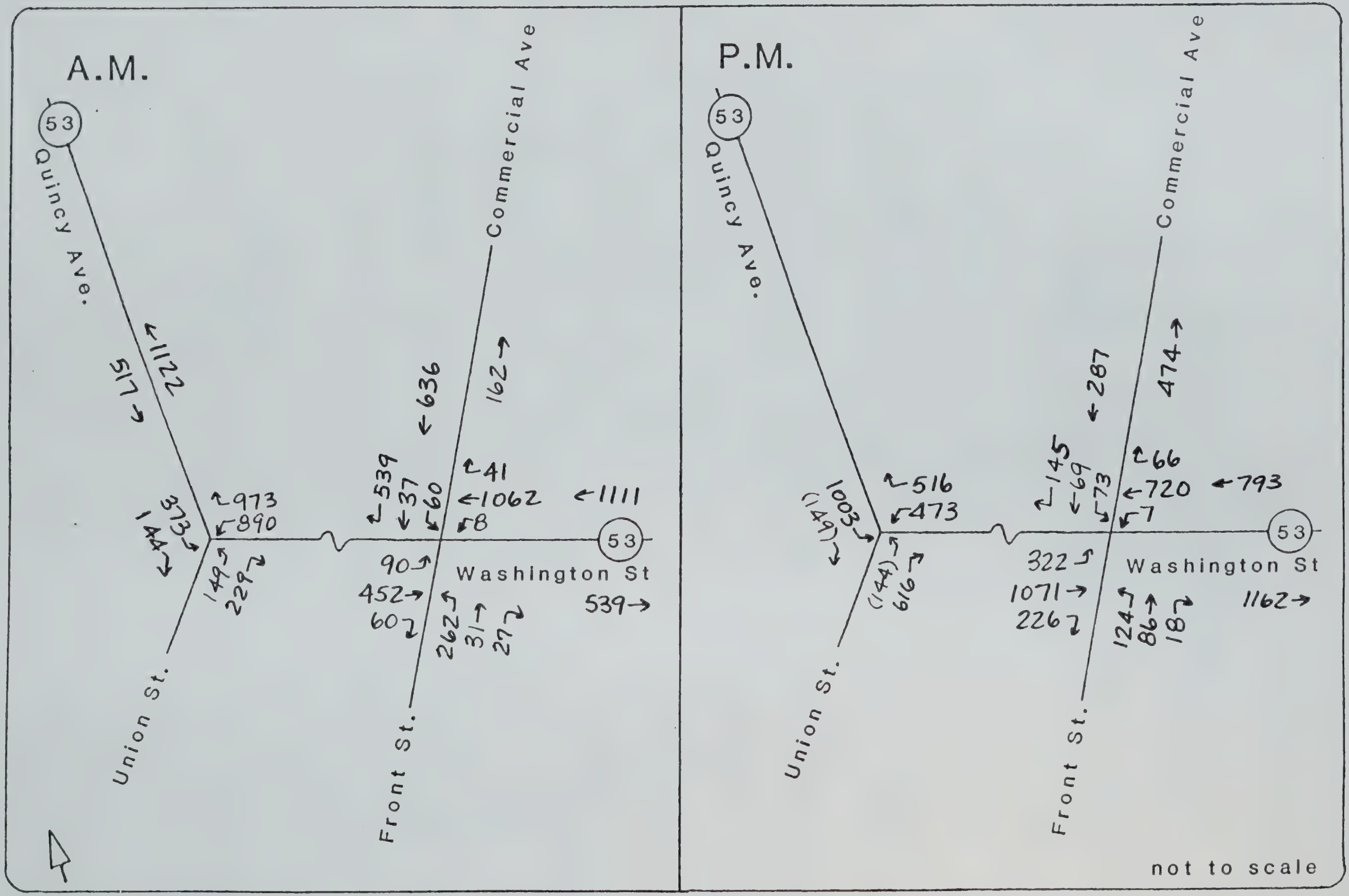

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FIG. 22-1
GREENBUSH: Weymouth Landing
EXISTING TRAFFIC

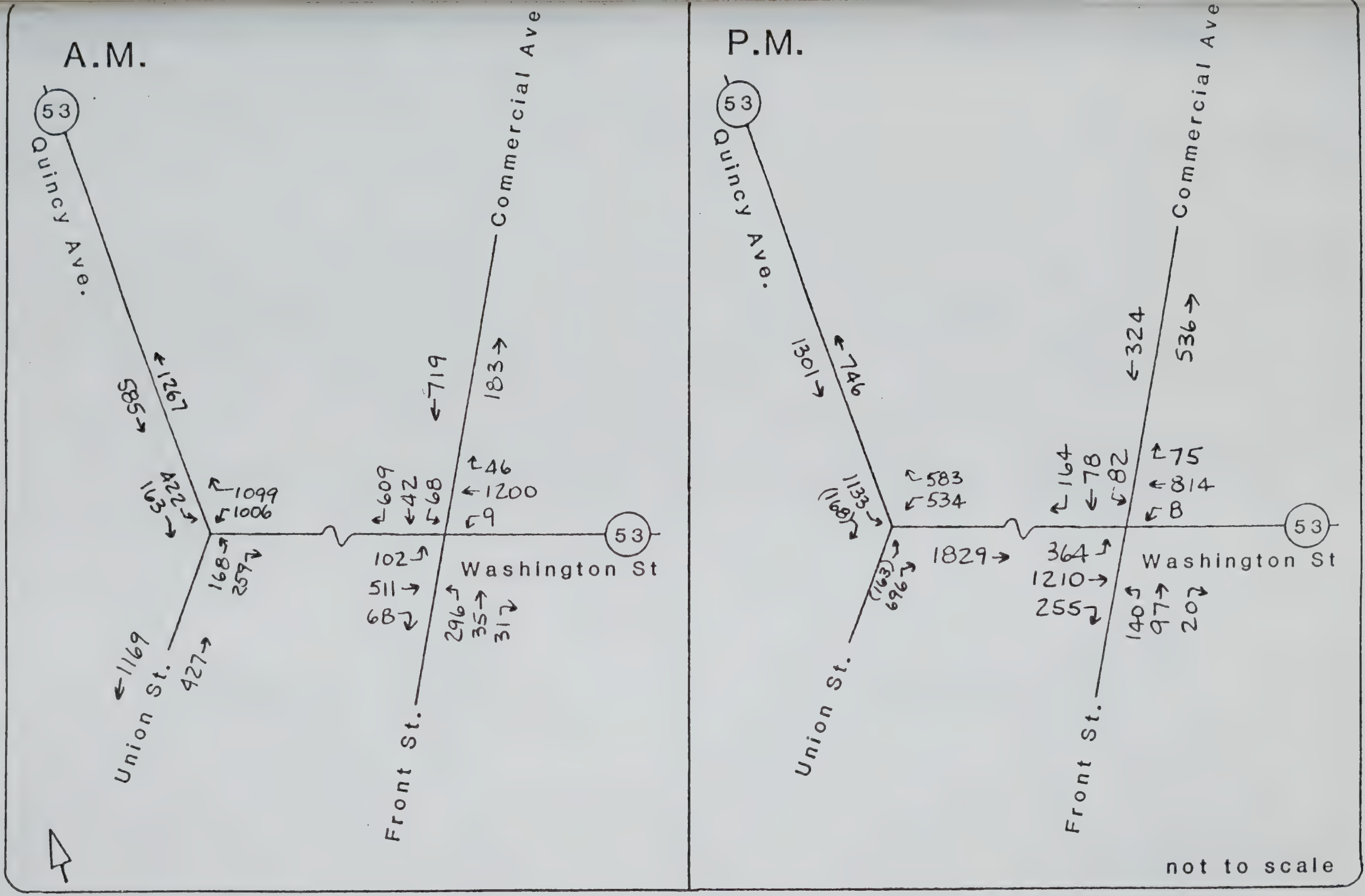

FIG. 22-2
GREENBUSH: Weymouth Landing
YEAR 2000 BASE

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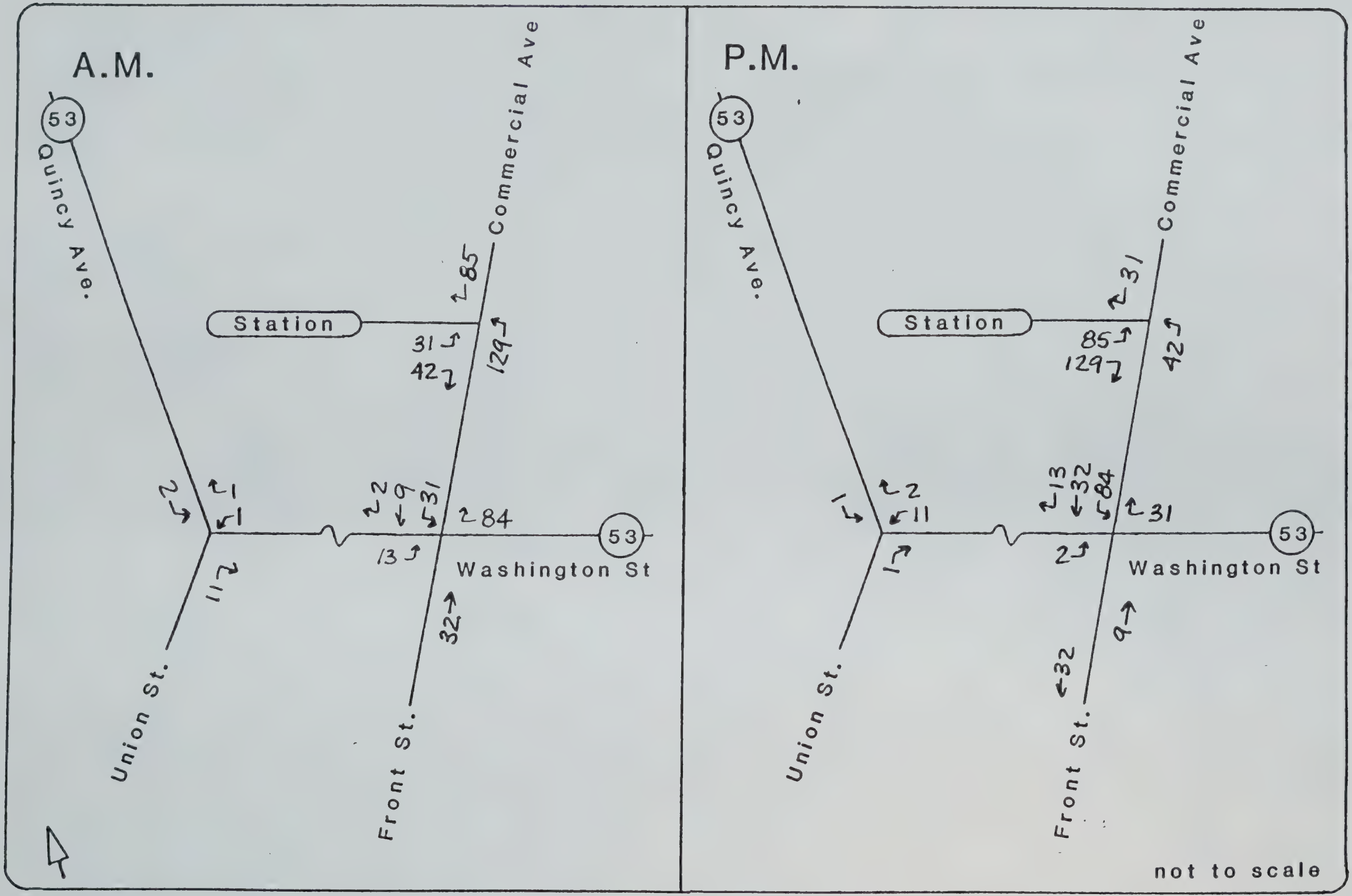

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FIG. 22-3
GREENBUSH: WEYMOUTH LANDING
STATION VOLUMES

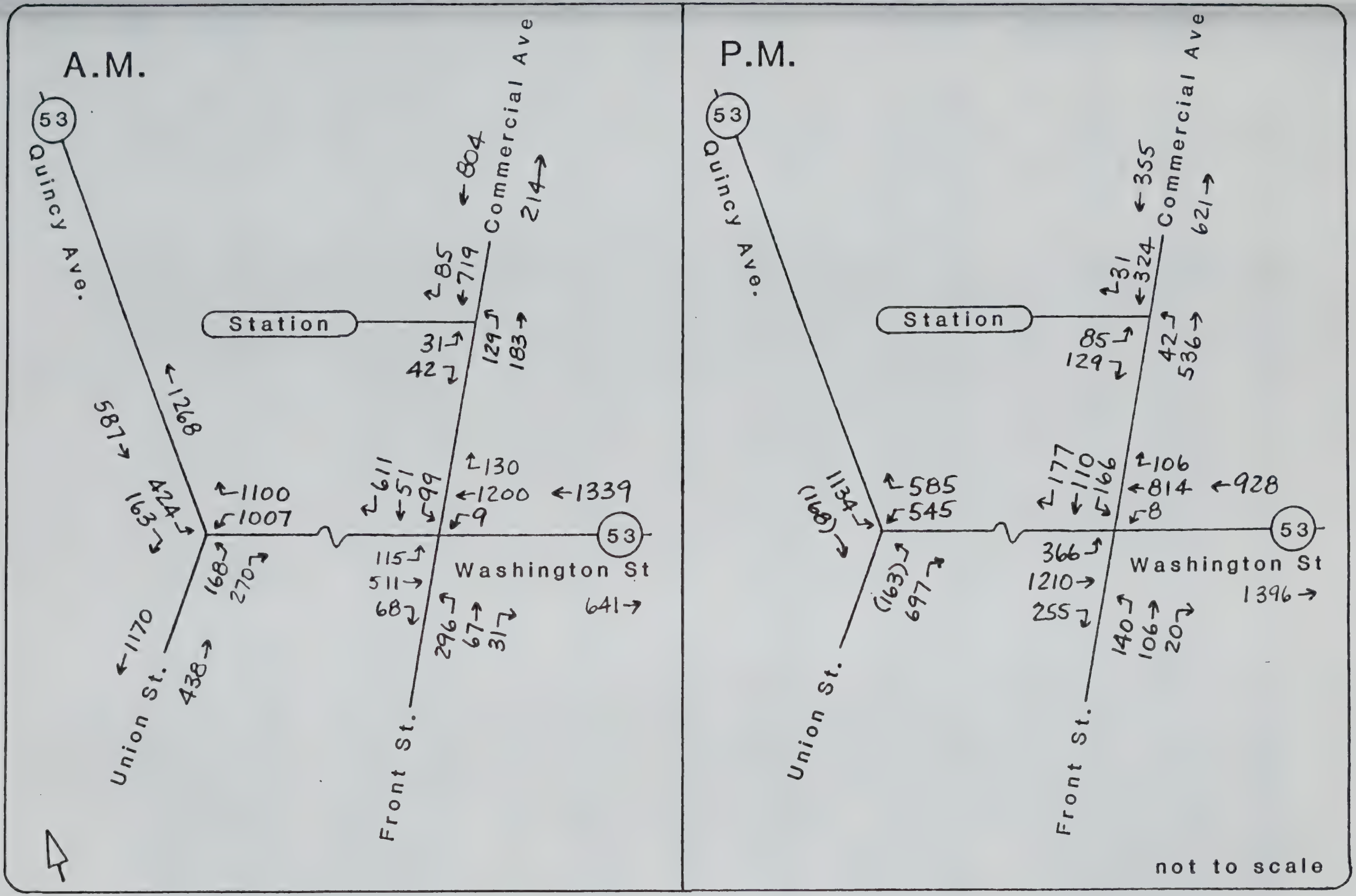

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FIG. 22-4
GREENBUSH: WEYMOUTH LANDING
FUTURE TRAFFIC WITH STATION

23. East Weymouth Station and Line Segment from North Street, Weymouth to Weymouth-Hingham Line

This segment runs from North Street, Weymouth to the Weymouth- Hingham Town Line on the Greenbush Branch. It includes five grade crossings plus a proposed station site on Commercial Street east of Jackson Square on the site of the present Bowl-a-Way Bowling Alley. Traffic impacts would include vehicle queues and delays at grade crossings associated with train passbys, and additional traffic generated by a commuter rail station.

23a. Existing Streets

The principal street serving the station site is Commercial Street, which serves as an east-west arterial across northern Weymouth. Commercial Street is a winding street, 2 travel lanes wide plus shoulders, for most of its length through East Weymouth, except for the section where it passes through Jackson Square and Lower Jackson Square--the intersections of Commercial, Broad and Pleasant Streets, and Commercial, High, and School Streets respectively.

This area is the local business center for East Weymouth. Currently, it experiences traffic congestion and accidents, largely because of the confusing directional turns in Commercial Street, the lack of signal control in the Lower Square, and the "island" configuration of Pleasant and School Streets.

An Urban Systems project to rebuild the Jackson Square area is underway. Elements of the redesign include:

- Installation of new traffic signals.
- Relocation of some on-street parking, and creation of a parking reservation between the two ends of the Square.
- Provision of clearly-marked left- and right-turn lanes where appropriate, with additional channelization and signage.

The proposed station site is located just east of the Lower Square along Commercial Street as it approaches the Hingham line, and immediately before a sharp horizontal curve. The street at this point has been recently repaved and curbed; there are sidewalks on both sides, with several commercial driveways on the west side (including the bowling alley), and residential driveways on the east side, of the street.

23b. Existing Volumes

No pre-existing traffic counts were available for Jackson Square in connection with the pending Urban Systems Project. Therefore, new Peak Hour turning movement traffic counts taken at several area locations were the primary source of existing volume information at this location. Figure 23-1 displays balanced traffic volumes for 1987.

23c. Accident Experience

Town of Weymouth Police records were consulted to determine accident experience at intersections in the East Weymouth area. The resulting numbers of reported accidents for 1986 and 1987 are shown in Table 23-1 below.

Of these, the only noteworthy location is the general Jackson Square area (Commercial/Broad/Pleasant/High/School), where the existing awkward geometry and lack of traffic control presents numerous opportunities for conflicts. The pending Urban Systems project was designed in part to reduce such conflicts and allow more orderly assignment of right-of-way in this area.

During the accident investigations, Weymouth Police were asked specifically about accident experience at the sharp curve on Commercial Street near the bowling alley. The response was that in fact few accidents occur at this curve, because the area is well-marked and newly-repaved, and because Weymouth Police use radar to keep a close watch on speeds in this area.

23d. Future Growth Assumptions

For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 1 percent per year, were computed and are presented in Figure 23-2.

Given these growth levels, the future Levels of Service were calculated for the Jackson Square area and for intersecting streets, including East Street and station driveways. The resulting LOS levels are shown in Table 23-2.

For unsignalized intersections, LOS results are calculated separately for each critical move. Values of "E" and "F" for left-turns from minor streets to major ones indicate the delays commonly experienced by these vehicles waiting for gaps in heavy opposing traffic streams.

23e. Station Traffic

Patronage forecasts for an East Weymouth station, by mode of access, were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, Alternative 3c, Middleborough and Greenbush Lines only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 271 daily parkers, 130 daily drop-offs at the East Weymouth station location.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 163 parking vehicles arriving AM, departing PM, and 78 drop-off vehicles entering and exiting the station in each peak hour.

These trips were distributed on the road network providing access to the proposed station based on towns of origin and residential densities. Figure 23-3 shows these distribution assumptions.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Commercial or other streets. In fact, however, it is more likely that some station traffic, particularly Weymouth and Hingham resident traffic, is traffic which would otherwise use local streets to access Route 3 or 3A, Route 53, or an intermediate park-ride facility such as the Braintree Red Line station or Hingham commuter boat.

Total Year 2000 traffic volumes with a commuter rail station at the Bowl-a-Way site, as depicted in Figure 23-4, represent increases above Base 2000 volumes as shown in Table 23-3, depending on location. Level-of-Service results for each intersection under future volume conditions are shown in Table 23-2.

The sharp curve in Commercial Street just east of the proposed station site presents a sight distance limitation for traffic entering and exiting a rail station at the proposed site, if the driveway is located close to the curve. Stopping sight distance for Commercial Street WB traffic is adequate at the more westerly of the 2 existing bowling alley driveways, but are inadequate at the driveway closest to Wharf Street and the roadway curve. Left-turn sight distance for EB Commercial Street traffic entering the station is adequate for 30-35 mph opposing-traffic speeds, but short of the 470 feet preferred at 40 mph approach speeds.

AASHTO recommended values for stopping sight distance and entering left-turn sight distance are:

Design Speed,mph	SSD, ft.	Left-turn SD, ft.
30	200	240
35	225-250	360
40	275-325	470

Observed sight distance looking westward towards the farther bowling-alley curb cut (i.e., between the bowling alley and the ice-cream stand), was 400-430 feet. Sight distance to the closer curb cut (i.e., close to Wharf Street) is 310-325 feet. Speed limits on Commercial Street are 30-35 mph, but these speeds tend to be exceeded when traffic is light. Thus, the closer curb cut is on the margin of acceptability, and probably would not represent a satisfactory point of access for a station. A station entrance at or west of the more westerly driveway would be acceptable from a sight distance point of view.

Concern about sight distance at this site can be partly addressed by:

- Location of the station driveway as far westerly as possible along Commercial Street, to maximize sight distance.
- Creation of lengthy left-turn storage capability (at least 10 cars, or 220 feet) on Commercial Street, to allow vehicles room to wait for safe gaps in opposing traffic.
- Provision of signing to warn westbound motorists of the upcoming rail station, and imposition of additional speed restrictions on

this section of Commercial Street.

23f. Grade Crossings

The five grade crossings in this segment are located at Green Street, Unicorn Avenue, East Street, Wharf Street, and Commercial Street. The Green Avenue crossing occurs between 2 closely- spaced signalized intersections. Because these intersections are so close to the track, traffic signal controllers at both will need to be replaced and railroad pre-emption installed to insure safe operation.

None of the other four grade crossing locations is close to a signalized intersection. Analysis of likely and maximum queue lengths resulting from train passbys was performed at all but Unicorn Street, which is a residential street, with little queueing anticipated.

A commuter train passby is assumed to require a maximum gate closure of 90 seconds. The proposed schedule calls for half-hour commuter-train headways on the Greenbush Line during peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

- The results of the queuing analysis are summarized in Table 23-4. Only those approaches where the potential exists for queued traffic to back up into an adjacent intersection with a major street were explicitly considered for this analysis.

"Peak" 90-second arrival rate represents the number of arriving vehicles per 90-second period which will be exceeded less than 5 percent of the time (assuming random vehicle arrivals).

With an assumed start-up delay time of 2 seconds per vehicle, the average delay per stopped vehicle will be 45 seconds (half the stop time) plus the start-up delay for the median vehicle; or just under or over 1 minute. This represents a delay of about 1 extra signal cycle.

At Green Street, signal pre-emption will hold through traffic at the flanking intersections for the duration of the train passby, while allowing right-turning vehicles to move into the track approach. This will result in short-duration vehicle queues on the approach streets. The through movements will then be given first priority once the track clears. The net effect will be that, of the approximately 60 signal cycles per hour currently operating at these intersections, 3 of these in each peak hour will involve long (90-second) red intervals to through traffic in the direction of the track.

23g. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of crossing controls at all grade crossings including gates, lights and bells.

- Upgrading of existing traffic signals or installation of new traffic signals to provide railroad pre- emption sequencing at the two Green Street intersections on either side of the grade crossing.

- Commercial Street improvements at East Weymouth Station--provide left-turn storage on eastbound approach for a minimum of 10 cars, or 220 feet, but preferably 300 feet. This may require reducing sidewalk width in this location. Provide and stripe an exclusive right-turn lane for westbound traffic entering station. Use signing and speed restrictions on westbound approach upstream of curve to indicate upcoming station entrance and lane configuration.

A conceptual plan for this improvement proposed for the station entrance is shown in the DEIS, Chapter IX, Figure IX-C20.

TABLE 23-1

Accident Incidence from Weymouth Police Records

Intersection	Number of Recorded Accidents 1986	1987*
Commercial/Drew	0	1
Commercial/East	0	4
Commercial/Station	0	0
Commercial/Broad/Pleasant/High/School	13	13
Total Townwide Accidents	1495	711

*through June

TABLE 23-2

Level of Service Analysis
East Weymouth Station Area Intersections

Intersection	Currently Signal-ized?		Level of Service: Year 2000 Traffic			
			without East Weymouth Station		with East Weymouth Station	
			AM	PM	AM	PM
Broad/Commercial/ Pleasant	*		C	C	C	C
Commercial/East	NO					
		Lefts in	A	A	A	A
		Rights out	B	A	B	A
		Lefts out	F	F	F	F
Commercial/Station Driveway	NO					
		Lefts in	--	--	A	A
		Rights out	--	--	A	A
		Lefts out	--	--	E	F

*assumes signalization under the Urban Systems project.

TABLE 23-3

Percent Change over Base Traffic Volumes Represented by Station Traffic

Location	Herring Run AM	Herring Run PM
Commercial St. E of East St.	2%	2%
Commercial St. between Broad & High	3%	4%
Commercial St. E of High St.	27%	23%

Peak Direction Ony (WB in AM, EB in PM)

TABLE 23-4

Queuing Analysis: East Weymouth Grade Crossings

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Green Street					
--NB approach					
AM Peak Hour	203	5	10	*	50
PM Peak Hour	411	11	16	*	56
--SB approach to track					
AM Peak Hour	341	9	14	*	54
PM Peak Hour	320	8	13	*	53
2. East Street					
--NB approach to track					
AM Peak Hour	101	3	7	150	48
PM Peak Hour	130	3	7	150	48

3. Wharf Street (negligible traffic--no queuing problem likely)

4. Commercial Street (no major intersection nearby)

*because of signal pre-emption, vehicles queue primarily on approaches to upstream intersections: for NB, on North and Church Streets; for SB, on Green and East Streets. Queue lengths are proportional to approach volumes on each direction.

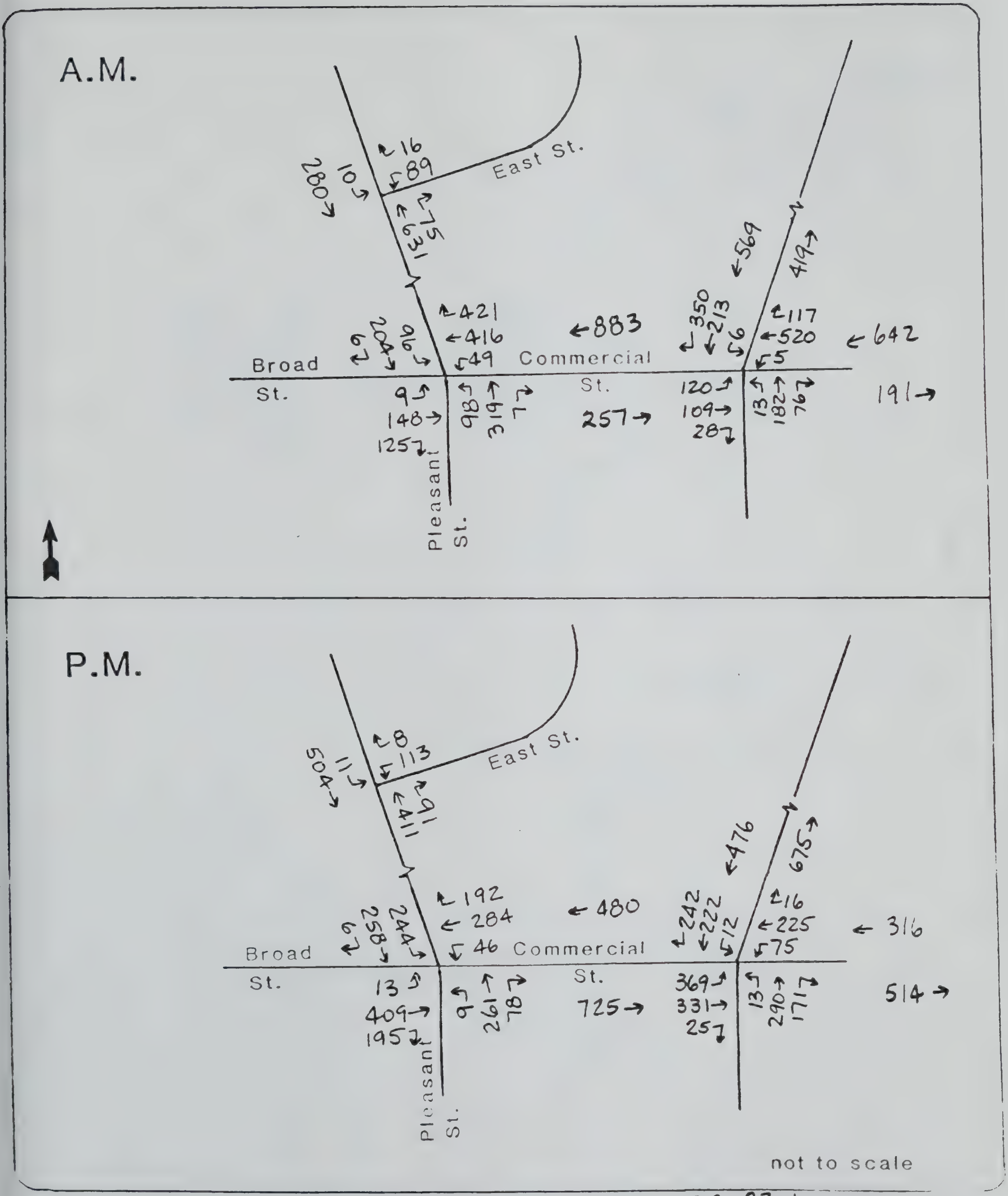

FIG. 23-1

GREENBUSH:
E. Weymouth

EXISTING TRAFFIC

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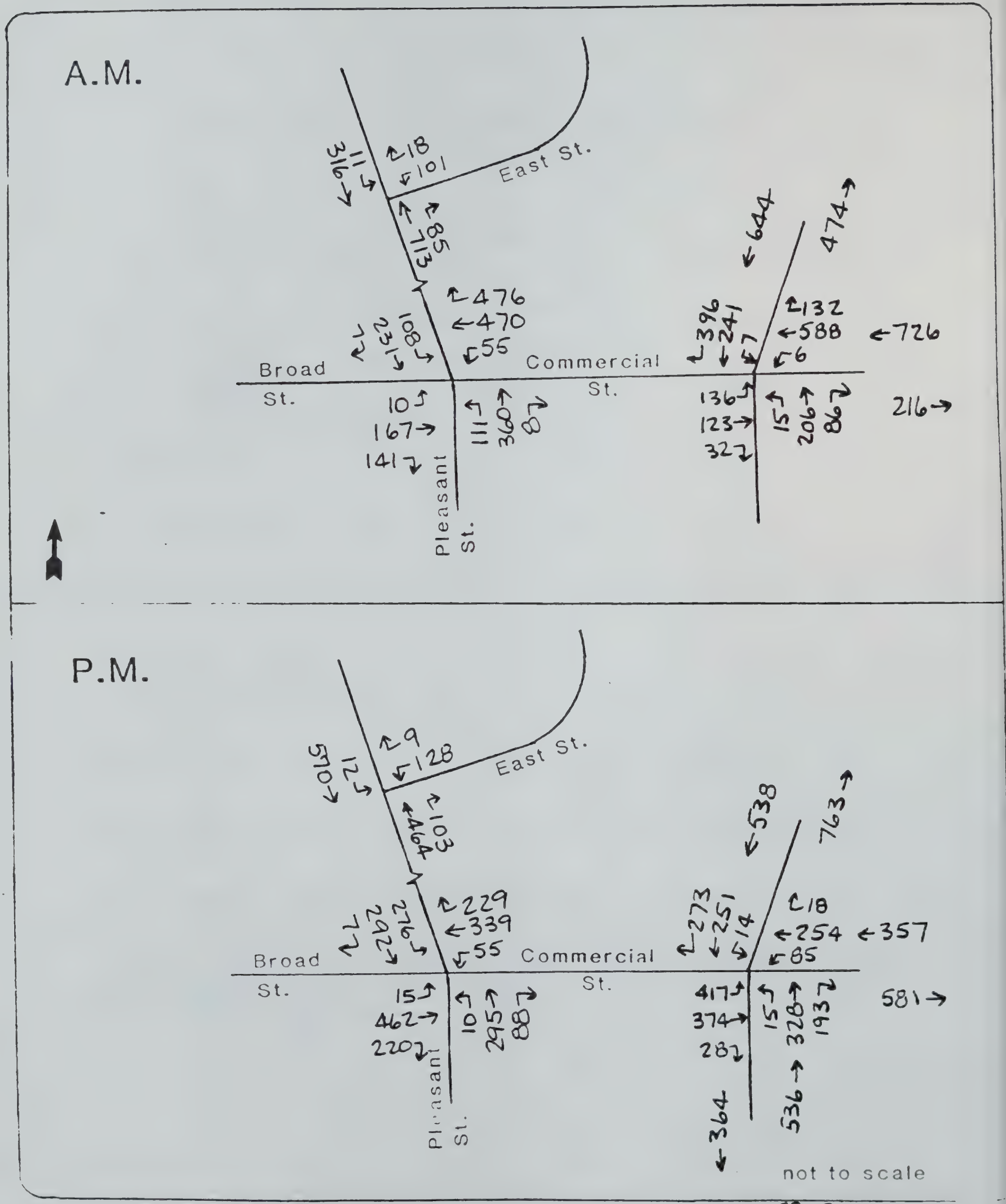

FIG. 23-2
GREENBUSH:
East Weymouth

YEAR 2000 BASE

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AUTHORITY

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Rehabilitation Project

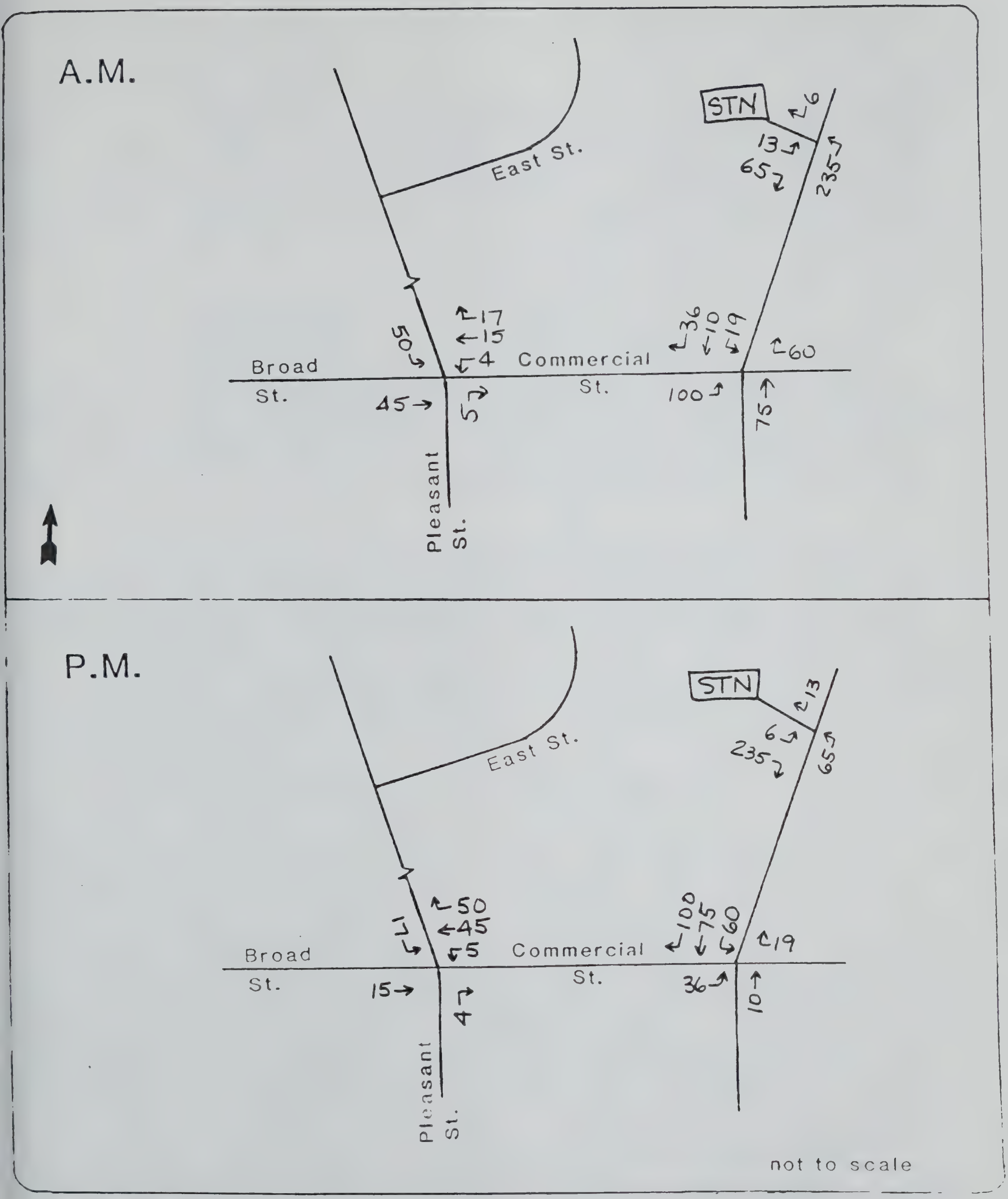

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FIG. 23-3
GREENBUSH: E. WEYMOUTH
STATION VOLUMES

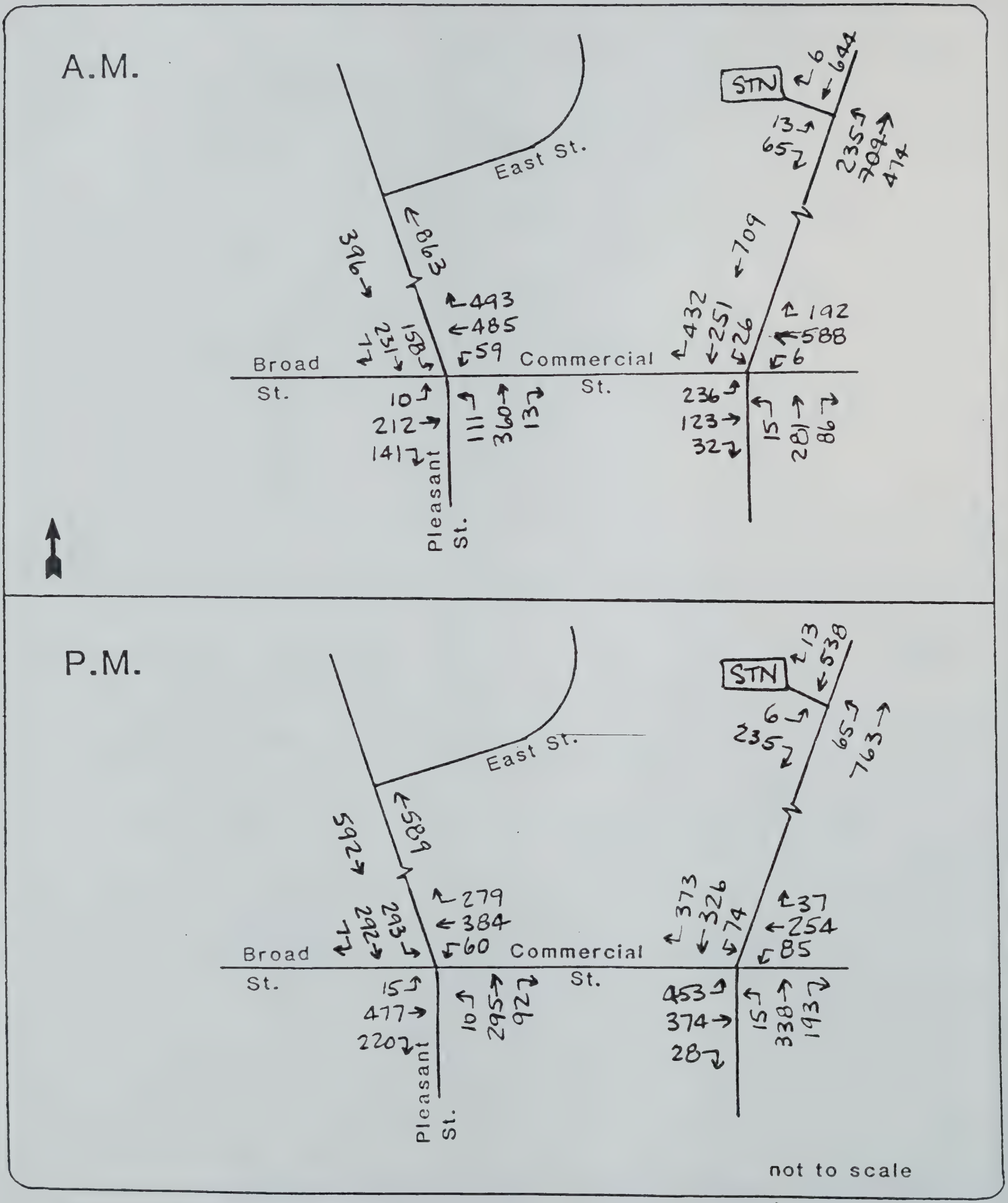

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FIG. 23-4
GREENBUSH: E. Weymou

FUTURE, WITH STATION

24. West Hingham Station and Line Segment from Weymouth-Hingham Line to Shipyard Spur Track

This segment extends from the Weymouth-Hingham Town Line to the point where the existing spur track to the Hingham Shipyard takes off, on the Greenbush Line. A station is proposed to be located on presently-vacant land opposite the Town-owned land on Fort Hill Street, approximately 330 feet west of the intersection of Fort Hill and West Streets. There is a grade crossing at this intersection, in addition to two other crossings of Fort Hill Street closer to the Weymouth Town Line.

24a. Existing Streets

The street providing direct access to the station site is Fort Hill Street, a suburban collector street which joins with South Street to provide east-west connections between Weymouth and Hingham Center. Fort Hill Street is approximately 40 feet of paved width close to the station site, with no sidewalks; it operates as 1 lane in each direction. Posted speed limit in this section is 30 mph, but traffic typically moves at around 35 mph. There are few intersecting streets, but numerous residential and other driveways along this section of Fort Hill Street.

East of the proposed station entrance, Fort Hill Street meets West and South Streets in a channelized 3-way intersection. West Street is a short residential street which becomes Beal Street north of North Street. It provides the most direct access between this area of northwest Hingham, and Route 3A near the Shipyard and commuter boat parking lot. The intersection was rebuilt within the past 2 years to improve channelization, and rubberized grade crossing material was installed here. The new design channels left turn movements onto the track, however, and causes skidding. This intersection is currently being re-evaluated in an attempt to correct this problem.

The entrance driveway to the South Shore Country Club is located on the south side of South Street just east of the grade crossing.

West of the station entrance, Fort Hill Street continues as a residential/collector street for about 1.3 miles, meeting Fresh River Street at 2 points before it becomes Commercial Street in Weymouth.

24b. Existing Traffic

Traffic counts were performed at the Fort Hill/West Street intersection (August 1986), as well as at the Town driveway opposite the station (as part of an earlier project--May 1984). The 2 counts were standardized to 1987 and balanced; the resulting traffic volumes are shown on Figure 24-1. They do not include school bus operations in the Town driveway, which were counted separately in 1984. Table 24-1 summarizes observed school bus sorties on that occasion.

Afternoon activity at the Town driveway site tends to be busier than morning activity, because of trips into and out of the Credit Union building, located close to the Main Gate, and the South Shore Conservatory of Music, located farther back on the former Naval Ammunitions Depot property.

24c. Accident Experience

Town of Hingham Police records were examined for information regarding accident incidence in this area. A total of 3 accidents were reported at the intersection of Fort Hill and West Streets during Calendar Year 1986, all involving property damage only. A gross estimate of accident exposure was made using the assumptions that peak hour traffic is 10 percent of ADT, and that total annual entering vehicles is 300 times ADT. The resulting estimate, 0.86 reported accidents per million entering vehicles, is below the statewide average reported by CTPS for unsignalized intersections (0.95).

24d. Future Growth Assumptions

Information on likely development projects in the Town of Hingham close to the proposed station site was sought from the Hingham Planning Board. The two sites which have been discussed as potential development sites are the former Naval Ammunition Depot site, directly across from the station location, and a portion of the South Shore Country Club, on the south side of South Street east of the West Street intersection.

The former Navy site has been proposed for residential development on several past occasions--once as cluster-type town houses, again as 90+ single-family lots. The South Shore Country Club site has recently been acquired by the Town, which has preserved the land as a golf course.

Development of 90 single-family units at the Navy site would generate as many as 90 2-way trips in the PM Peak Hour (ITE, Trip Generation, Land Use Category 210). Town-proposed recreational uses for the South Shore Country Club site tend to be low traffic generators, particularly during weekday peak traffic hours--ITE cites an average of 0.39, and a maximum of 1.45, vehicle-trip ends per acre of land for golf courses during the PM peak hour.

Consequently, it is reasonable to conclude that no new major traffic generators are anticipated in the vicinity of the proposed West Hingham Station site.

Even though no significant new development was identified in the area close to the station site, present-day volumes were adjusted to account for growth in through traffic and potential growth elsewhere in Hingham. For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 1 percent per year, were computed and are presented in Figure 24-2.

Patronage forecasts for a West Hingham commuter rail station on Fort Hill Street, by mode of access, were produced for rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for Alternative 3c, Middleborough and Greenbush Lines only were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 91 daily parkers, 49 daily drop-offs (December 1987 patronage forecasts).

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 55 parking vehicles arriving AM, departing PM, and 29 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 24-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic. None are assumed to represent local traffic already using Fort Hill or other nearby streets.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 24-4, represent increases above Base 2000 volumes of 8 to 11 percent on Fort Hill Street east of the driveway in the AM and PM Peak Hours. Level-of-Service results at Fort Hill/West Streets and at the station driveway under future volume conditions are shown in Table 24-2.

As noted on that table, none of the left-turn movements experiences degradation to LOS "E"--all remain at "D", albeit at a lower point in the range defining "D". This is quite acceptable, particularly for low-volume left turns at both West Street and the proposed station driveway. Volumes exiting the station site will generate minor vehicle queues within the station area in the PM Peak Hour.

Fort Hill Street has a slight horizontal curve at this location, and the station driveway is located on the inside of the curve. In order to preserve sight distance to the left, the ultimate station design should preserve the existing clear line of sight on Fort Hill Street. Shrubbery, signs, etc., should not be placed so as to block the view to the west of an exiting driver.

24e. Grade Crossings

The three grade crossings in this segment (all at Fort Hill Street) will be equipped with automatic gates with lights and bells, so that stopping sight distance for vehicles approaching crossings will not be an issue.

Of the three crossings, the most critical is the crossing at the intersection of Fort Hill/West and South Streets, because several approaches will be blocked simultaneously.

A commuter train passby is assumed to require a maximum gate closure of 90 seconds. The schedule calls for half-hour headways on the Greenbush Line during peak hours, with off-peak service at approximately 2-hour intervals. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

With the existing street layout, the right-turn move from West Street to Fort Hill WB is clear of the grade crossing, and could continue to move during a train passby if gates are placed appropriately. Other moves are affected by the grade crossing.

Queue lengths for all separately-channeled moves were estimated assuming a 90-second gate closure period, estimated "maximum" vehicle arrival rates on all approaches, and the existing intersection layout. These are summarized in Table

24-1 below.

On West and Fort Hill Streets, the busiest arrival period is the PM Peak Hour. Average vehicle arrival rate on Fort Hill Street EB per 90-second gate closure under Year 2000 volume assumptions is 18 vehicles, with a maximum (95th percentile) arrival rate of about 23 vehicles. This would result in a vehicle queue of just over 500 feet, queued in a single lane, reaching almost to the station entrance.

On West Street SB, only left-turning vehicles would actually need to be stopped; and maximum likely queues here are short (4 vehicles or less). But even short queue lengths will occasionally back up beyond the length of available pavement into the West Street NB lane.

A realignment scheme which provides adequate queue storage; creates standard right-angle left turns from Fort Hill EB; and ameliorates the problem of turning vehicles skidding on the tracks, was developed, and is presented in the DEIS, Chapter IX, Figure IX-C22.

This scheme was analyzed to estimate delays for each component. These are also summarized in Table 24-3. Estimates of total delay per passby are summarized in Table 24-4.

24f. Mitigating Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of fully- automatic gate controls at all grade crossings.
- Street improvements--provide left-turn storage lane on Fort Hill Street WB at station entrance; confer with local officials and the Massachusetts DPN regarding preferred configuration for Fort Hill/West/South Street intersection; modify geometrics at this location as necessary, following upon currently-pending improvements.

Conceptual plans for these street improvements are shown in the DEIS, Chapter IX, Figures IX-C21 and IX-C22.

TABLE 24-1

School Bus Operations at Hingham Town Driveway
(counted on 24 May 1984)

Time (a.m.)	Number of School Buses	
	Exiting	Entering
6:30-6:45	1	0
6:45-7:00	3	0
7:00-7:15	12	0
7:15-7:30	0	1
7:30-7:45	5	0
8:15-8:30	1	0
8:30-8:45	0	5
8:45-9:00	0	8
9:00-9:15	0	1
TOTAL	22	15

TABLE 24-2

Level of Service Analysis
West Hingham Station Area Intersections

Intersection	Currently Signal-ized?	Level of Service*: Year 2000 Traffic: without OC commuter station AM	without OC commuter station PM	with OC commuter station AM	with OC commuter station PM
Fort Hill/South/ West St.	NO	D (194)	D (146)	D (162)	D (121)
Fort Hill St./ Station driveway	--	--	--	D (171)	D (103)

*left-turn moves out of minor street/driveway; all other movements are LOS "A". Numbers in parentheses are Available Reserve values for left turns out of minor street.

TABLE 24-3

Queuing Analysis:
Fort Hill/West/South Street Grade Crossing
(PM Peak Hour)

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Existing Layout					
Fort Hill EB 1 lane	720	18	23	505	63
South St. WB	313	8	13	285	53
West St. SB Left	9	<1	4	88	46
2. Proposed Improvements--Hill EB lefts stopped by crossing					
Fort Hill EB					
Through	565	14	19	420	59
Left	155	4	8	175	49
South St. WB	313	8	13	285	53
West St. SB Left	9	<1	4	88	46

*residual, assuming left-turn exit blocked after first 7 through vehicles (150 feet) queued, and remaining left turns added to single-lane queue

TABLE 24-4

Total Vehicle Stopped Delay per Grade Crossing Closure
(PM Peak Hour)
Fort Hill/South/West Streets

	Average Number of Stopped Vehicles, All Approaches	Total Delay, All Stopped Vehicles, per Crossing
Existing Layout	27	26.7 minutes
Proposed Improvement	27	24.9 minutes

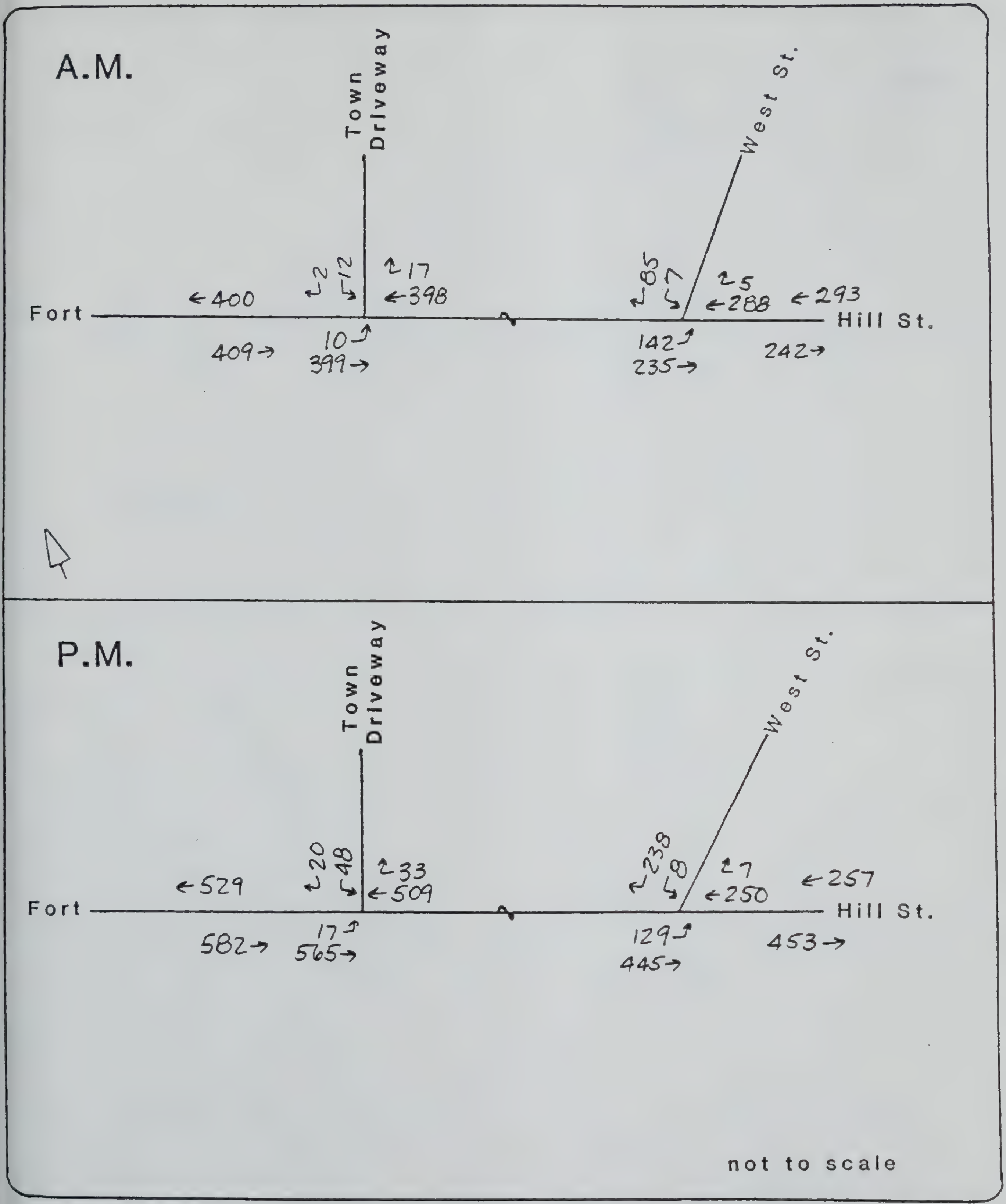

FIG. 24-1
GREENBUSH: WEST HINGHAM
EXISTING TRAFFIC

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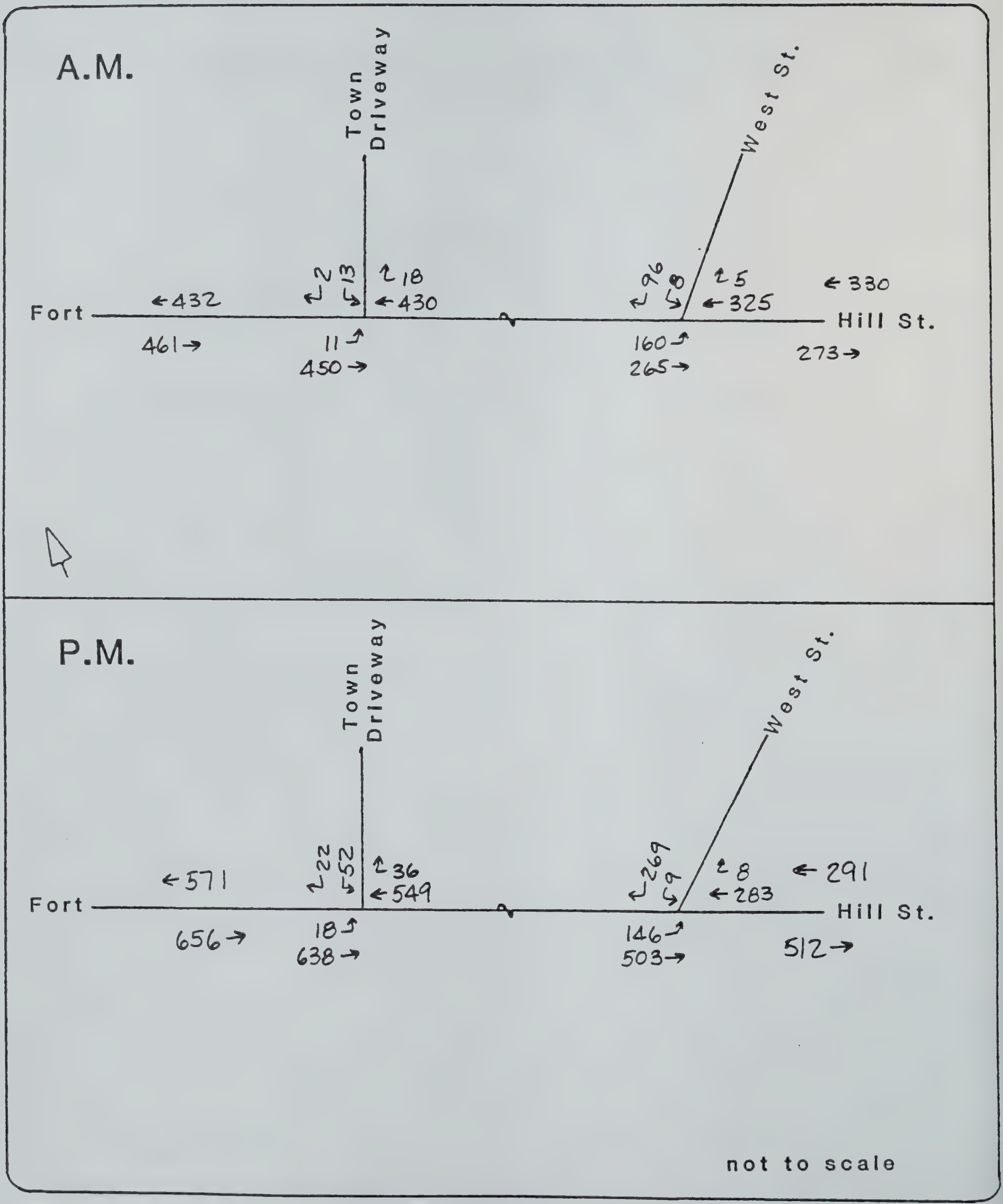

FIG 24-2
GREENBUSH: West Hingham
YEAR 2000 Base Traffic

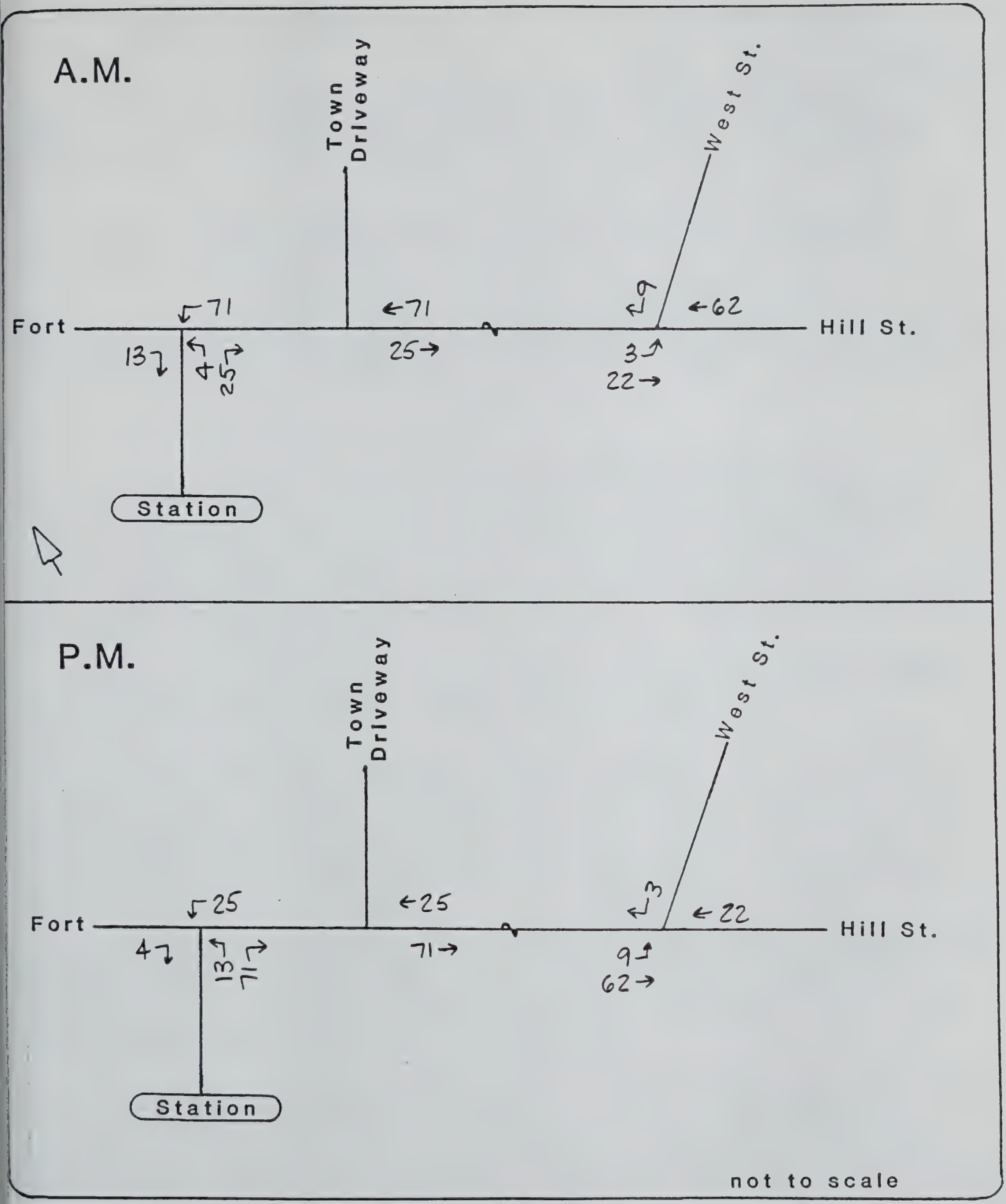

FIG. 24-3
GREENBUSH: West Hingham
Station Traffic

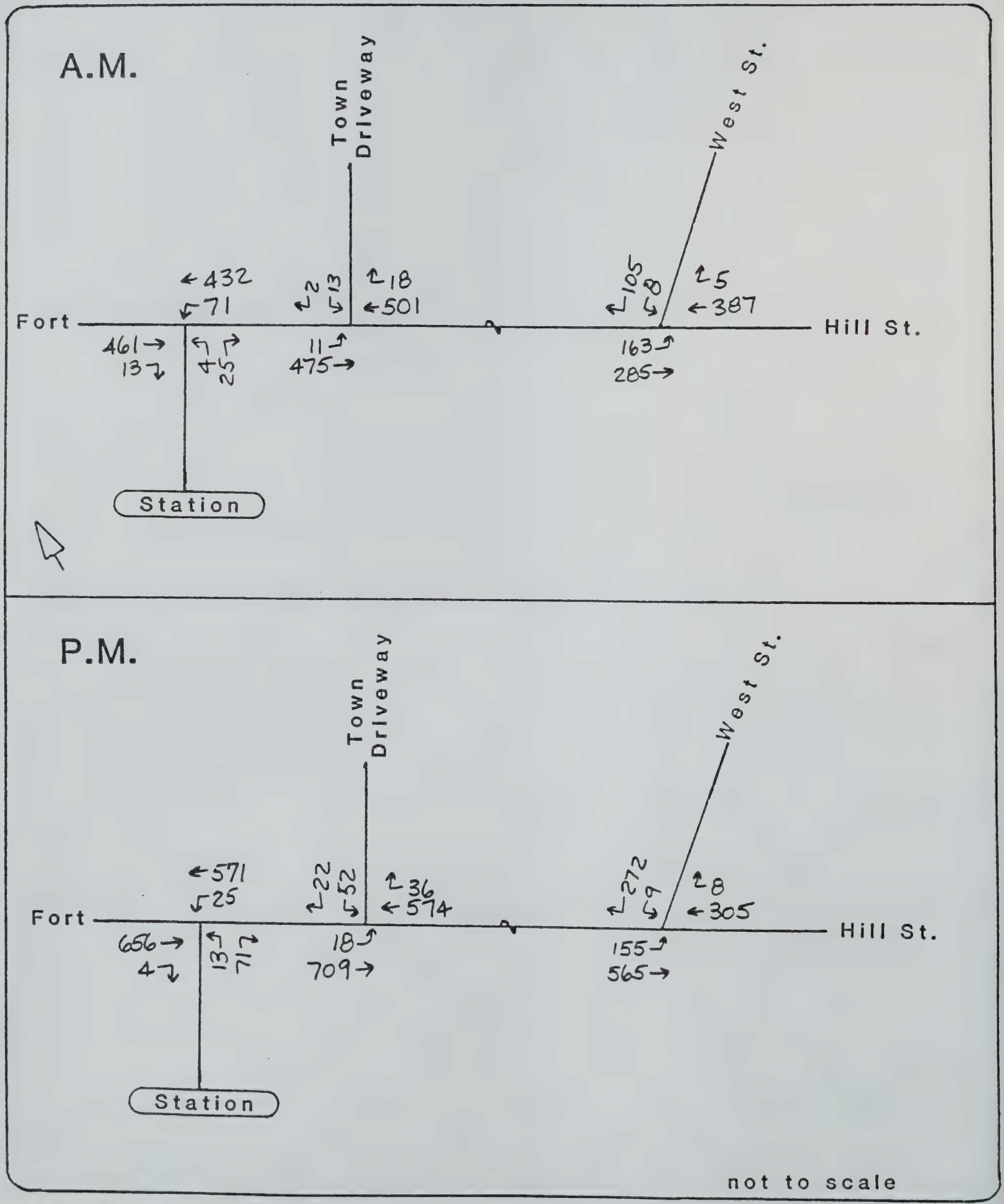

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FIG. 24-4
GREENBUSH: West Hingham
Future Traffic, with Station

25. Nantasket Junction Station and Line Segment from Shipyard Spur Track to Hingham-Cohasset Line

This section describes impacts of the segment from the Hingham Shipyard Spur Track to the Hingham-Cohasset Town Line, on the Greenbush Branch. This segment traverses the Hingham Square business district and the Lincoln Historic District occupied by many distinguished buildings of significant architectural value.

The Nantasket Junction station is proposed for the area bounded by Summer Street, Kilby Street, Route 3A and the track east of the town center. Access would be from Summer and Kilby Streets.

The primary street traffic impacts within this section would occur at the closely spaced grade crossings, particularly those in Hingham Square, and at the proposed station site. Station-generated traffic is considered first, followed by discussion of grade crossing impacts.

25a. Existing streets

North and South Streets, as described in the West Hingham segment, are local collector streets, which enter Hingham Square flanking the railroad right-of-way, and become part of the historic street network there, meeting just east of Main Street. Characteristic of 17th century street patterns, block lengths are short within Hingham Square, so that the cross-streets connecting North and South Streets (Main and Central) are only 220 feet apart. There are no traffic signals or other controls (except stop signs) in Hingham Square; traffic moves slowly through the square, particularly on the cross-streets.

On-street parking exists on most block faces, with a few angle parking spaces provided at key locations. Movements into and out of parking spaces in the Square area tend to slow traffic movements through the area.

A count of parking movements at the angle parking area on Main Street at South was conducted in August 1987, to determine the intensity of this activity during the evening peak period. The results of that count are summarized in Table 25-1. They show fairly intense parking activity here, peaking in the early afternoon (4:00-5:00). All spaces were usually filled, so that entering vehicles generally claimed spaces which had been vacated shortly before, within the same count period.

In addition to these legal parking areas, illegal parking, frequently by commercial abutters, currently takes place on the railroad right-of-way itself. On August 5, 1987 at 3:45 p.m. a total of 59 private automobiles, 4 trash dumpsters, and 1 storage trailer were counted on the right-of-way between the area west of Central Street and that east of South Street.

East of Hingham Square/Water Street, North Street meets Route 3A in the Hingham Rotary, a 4-leg traffic circle. On the far side of the Rotary, Summer Street/George Washington Boulevard is the main route to the Town of Hull. This street is a 4-lane undivided arterial street of high quality between the Rotary and George Washington Boulevard, posted for 35 mph. Two signalized intersections occur in this stretch:

- Summer Street/Washington Blvd./Martin's Lane. This intersection is scheduled by the Mass. DPW to be rebuilt. Improvements here are primarily intended to improve sight lines and approach angles for Martin's Lane, a narrow residential street which provides the primary access to the World's End conservation area.

- George Washington Blvd./Rockland Street. This is a 3-way intersection with Rockland as the minor approach. Rockland Street is 2 lanes wide, undivided, posted for 35 mph speed.

Justice Cushing Highway (Route 3A) between the Hingham Rotary and Hull/East Street (Route 228) is a 2-lane arterial street with shoulders, posted 50 mph. The 2 principal intersections along this stretch (Summer and Kilby) are stop-sign-controlled. Route 3A provides the principal access to Route 228 and Route 3 for commuters from south of Hingham, including Cohasset and Scituate residents.

25b. Existing Traffic Volumes

AM and PM Peak Hour turning movement traffic counts were performed over the course of this study at a number of locations close to the proposed station, with a limited number of PM peak hour counts conducted in Hingham Square to identify maximum likely queuing conditions. In addition, pre-existing counts were collected from several recent traffic studies in the area, notably:

- The Hull Town Center study (Vanasse Hangen Brustlin, 1987)

- Town of Hingham 2-way automatic counts (December/January 1983/4, and May 1984).

Data sheets for newly-performed counts are included in the Appendix to this report. All available counts in the station area were balanced, and are presented as Existing Traffic Volumes in Figure 25-1. Available data for Hingham Square is presented in the "Grade Crossings" discussion.

Generally, traffic was observed to flow smoothly in the vicinity of the proposed station. The directional split on Route 3A is very pronounced: 85 percent northbound in the AM Peak Hour east of Summer Street, 73 percent southbound in the PM Peak Hour. Even at Route 3A, however, despite fairly high travel speeds, exiting side-street vehicles experienced only minor-moderate difficulty in finding gaps in the oncoming traffic stream. Observations made of exiting traffic from Summer Street onto Route 3A are summarized in Table 25-2 by 15-minute period. They showed an "average wait" of 30 seconds per exiting vehicle as the longest 15-minute average; the second-longest "average wait" was 18 seconds.

Level-of-Service analysis applied to several intersections in the area yielded results as shown in Table 25-3. The observed waiting times for turns are actually shorter than those associated with LOS "E". It is possible that the signal at Route 228, about 1/2 mile east of Summer Street, causes westbound platoons to form, which are not fully dispersed by Summer Street; or that the values reported in the manual assume more conservative gap acceptance than people commonly observe in Massachusetts.

25c. Accident Information

Data obtained from the Hingham Police Department summarized recorded accidents at locations near the proposed station site for Calendar Year 1986. The totals are presented in Table 25-4.

None of these totals is unusually high, although it is interesting to note that the Kilby Street intersections with both Route 3A and Route 228 appeared to have greater numbers of incidents than the Summer Street intersections with either numbered highway. The Town-wide recorded accident total for 1986 was 1,307.

25d. Future Growth Assumptions

No pending projects were identified in Hingham. However, extensive development is anticipated in neighboring Hull, which is accessible only via the arterials which traverse Hingham (esp. Geo. Washington Boulevard, Route 228, and, to a lesser extent, Route 3A. Hull growth, and its potential impacts on Hingham east of the Rotary, were analyzed in the recent Hull Town Center study (April 1987). This anticipated growth was accounted for in the development of growth factors for traffic in the area of the Nantasket Junction station, as described below.

For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 1 percent per year (uncompounded), or 13 percent overall, were computed for Hingham Square only. East of the Hingham Rotary, higher annual percentages were used, to account for Hull-generated future traffic growth. An overall growth of 50 percent over existing traffic was assumed on George Washington Boulevard, with 20 percent (or about 1.5 percent per year) assumed elsewhere in the station area.

Station area base traffic using these latter assumptions is presented in Figure 25-2. The Hingham Square area is covered later under "Grade Crossings". Level of Service analysis was applied to station area intersections; the results are summarized in Table 25-3 above.

Generally, traffic growth causes deterioration in service for left-turn and through movements at the unsignalized intersections at Route 3A. This is because side-street traffic begins to have difficulty finding gaps in the high-speed Route 3A traffic stream. This condition could be ameliorated to a large extent by signalizing one of the 2 intersections.

25e. Station Traffic

Patronage forecasts for a Nantasket Junction station, by mode of access, were produced for the 2 rail alternatives which include this station, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for

Alternative 3C, Middleborough and Greenbush Lines only, were used to determine peak hour vehicle attractions to the station. This resulted in an assumption of 284 daily parkers, 124 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 170 parking vehicles arriving AM, departing PM, and 74 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 25-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using Route 3A, Washington Boulevard, or other streets.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 25-4, represent increases above Base 2000 volumes in the range 3-8 percent on Summer/Rockland Street and Route 3A, depending on time of day. Percentage increases on minor streets like Summer and Kilby are much higher because base volumes are very low, on the same order as station-generated volumes. Level-of-Service results for each intersection under future volume conditions are shown in Table 25-3.

Very little change is observed between No-Build and Full-Build conditions. At Route 3A/Summer Street, left turns from Summer onto Route 3A SB, on the low end of "E" for No-Build, fall into LOS "F" because of their increased numbers. At other locations, no change in LOS category occurs, although some reserve capacity is used by added station volumes.

The principal reason for the LOS "F" values observed for left turns onto Route 3A is the high through volumes on the major street. As mentioned earlier, left turns currently being made out of Summer Street have an easier time than the Existing LOS "E" would suggest here, possibly because of platooning. If such conditions continued to exist in the future, operations might still be satisfactory even with higher volumes. Such a conclusion would require additional field observation at this location, to determine actual vehicle arrival patterns on Route 3A.

In the event that turning delays at Summer and Kilby Streets do become unacceptably long, the most straightforward corrective measure is traffic signalization at one of the two intersections, preferably at Summer Street (since Kilby Street gaps would then be created by upstream signals in both directions). Operation of this location as a semi-actuated signalized intersection would allow the creation of gaps for side-street traffic, while minimizing delay to the major through movements on Route 3A.

LOS results at this location under a signalized regime, with future volumes given a train station, would be "B" during both Peak Hours.

25f. Grade Crossings

There are eleven grade crossings located in this segment, seven of which are in close proximity with the Hingham Square and historic district areas.

These seven are at South Place, Hersey, Central, Main, South and Water Streets; and Eldridge Court. The remaining four are located to the east toward Cohasset, at Summer, Kilby, Weir and Hull Streets.

1) Hingham Square

Existing PM Peak Hour traffic in the Hingham Square area is summarized in Figure 25-5. As with station area traffic, existing volumes were increased by 1 percent per year to provide an estimate of future traffic loadings in the Square area. Figure 25-6 presents this future Base Traffic assumption. Volumes here are low in the PM Peak Hour, and will remain low under future assumptions.

In Hingham Square, as noted earlier, traffic moves at a slow speed appropriate for a commercial area with frequent intersections and large numbers of pedestrians and parked cars. Travel speeds pick up on North and South Streets west of the business area.

The dilemma in this area results from the short distances between grade crossings, and the very limited area available for safe queuing at most of the crossings. The approximate distances between the crossings are: Moving from west to east

- South Place to Hersey	600′
- Hersey to Central	1800′
- Central to Main	200′
- Main to South	300′
- South to Water	1300′
- Water to Eldredge Court	500′
Total	4700′ = about 0.9 miles

The approximate distances available for vehicle queuing on the cross-streets, between track stop lines and the corner of the nearest intersection, are as shown in Figure 25-6.

Analysis was performed to determine the lengths of likely average and maximum (95th percentile) Year 2000 queues at the key crossings in the square for which PM Peak Hour traffic data was available. Only one-lane queues were assumed, although at some locations (notably Hersey Street), the street is wide enough so that 2-lane queues could have room to store, given the proper channelization. The results of this analysis are also shown on Figure 25-6. They can be summarized as follows:

- Average queue lengths are clear of the adjacent intersection only at Hersey Street SB, South Street SB, both directions on Water Street, and probably at Eldredge Court, although no counts are available to substantiate the last of these.
- Average queue lengths spill over into the intersection at all other approaches, probably including both directions on Central Street, which

has similar volume characteristics to Main Street.

- "Maximum likely" (i.e., 95th percentile) vehicle queue accumulations spill over into the adjacent intersections at all locations except Water Street. On Water Street, SB queues block Station Street, but are well clear of Route 3A and the Rotary approach.

In the Hingham Square area, this will mean that:

- PM Peak-Hour train passbys will routinely tie up the four intersections of Main and Central with North and South Streets.

- Queue spillovers will routinely occur also on South Street at the Hersey Street NB track approach.

- Occasionally, queues will back up into North Street at the Hershey Street SB track approach crossing, and at the South Street WB track approach.

In addition, since Hersey, Main, and Central Streets where they intersect with North and South Streets, and South Street where it meets North Street, effectively function as minor streets intersecting with major streets, vehicles waiting for gaps in the major street flows can potentially back up from the intersection across the track, particularly where the available distance is shorter than about 3 vehicle lengths (about 65 feet); i.e., at Hersey Street, where the crossing is almost in the intersection with South Street, and at the Main Street approaches to both North and South Streets. (See Table 25-5.)

Several alternative circulation schemes/street designs have been investigated to mitigate traffic impacts of reactivating train service through Hingham Square. These are discussed and compared below.

Under Alternative 1 (DEIS Chapter IX, Figure IX-C23a) Main Street between North and South Streets would be closed to traffic, in order to eliminate northbound traffic queue conflicts on Main and South Streets. Under this scheme:

- Separate left- and right-turn queuing lanes can be provided on Main St. northbound, so that queuing conflicts can be reduced.

- The Central/South Street intersection carries the diverted traffic, and requires signalization.

- A traffic signal is also required at North/Central, to handle the higher left-turn volume from Central to North Street.

- South Street carries heavier volumes in both directions, so that on-street parking needs to be removed.

Alternative 2 (DEIS Chapter IX, Figure IX-C23b) leaves both the Main and Central Street crossings open, but removes most on-street parking from these streets and includes traffic signals, pavement stripping, and selective channelization improvements where room permits. It represents the "minimum-change" alternative, compared with existing conditions, and has the following effects:

- Traffic queues still occur, but are "managed" by signalized control at key points (Central/South, Central/North, North/South).

- Two storage lanes in each direction are provided on Main street between North and South, and separate turning lanes are striped on Central Street NB at North.

Alternative 3 (DEIS Chapter IX, Figure IXC-23c) represents a partial one-way circulation scheme, with North Street one-way westbound between Central and South Streets, and South Street one-way eastbound between Central and North Streets. This scheme increases capacity on the one-way portions, but requires the least displacement of existing on-street parking of any of the following 3 "build" alternatives:

- Left-turn conflicts are eliminated at several locations, notably on North Street Westbound at South, and on Main Street Northbound at South.

- The maximum room for queue storage is provided on South Street Northbound east of Main St. South St. may still be blocked by queues, however, because northbound Main St. traffic bound for North/Lincoln Streets must all turn left at North/Main.

- Two lanes can be reserved for southbound traffic on Central Street, because there is no need for a northbound right-turn lane. The southbound volume is much higher than in the base case, however, because all traffic entering Hingham Square from the western end of North Street is directed down to South Street.

All 3 alternatives represent an improvement over the existing "base" condition, in which all intersections are governed by stop signs (a flashing red-yellow beacon also operates at Main/South Streets). Of the 3, Alternative 2 probably represents the most improvement for the least disruption. All 3 alternatives are presented here because they are all being carried forward as alternatives for public discussion during the hearing process.

2) Other Grade Crossings

Analysis of queues at the remaining four grade crossings outside the Hingham Square area is presented in Table 25-6. The vehicle arrival estimates and queue lengths are based on traffic volumes with the station, as shown on Figure 25-4, for Summer and Kilby Streets. No counts were available for Weir Street, but volumes here were believed to be similar to those on Summer and Kilby.

For Hull Street (Route 228), an approximation procedure was used to estimate traffic volumes, based on averaging existing counts at two flanking intersections (Hull/Rockland and Hull/Route 3A), available from the Hull Center study. The resulting averages were then increased by 50 percent, consistent with other volumes in the assumed high-growth corridors used by Hull traffic. These future estimates are presented in Table 25-6 as anticipated arrival rates at the Hull Street grade crossing.

The distances to nearest intersection for each of these four crossings is shown on Table 25-7. The only location where it appears the potential exists for queues to back up across or into adjacent intersections is at Hull Street. The "maximum likely" SB queue in both AM and PM Peak Hours will back up to a point beyond the southerly Fisher Road intersection, a residential arc-shaped street which meets Hull Street again beyond the range of the maximum likely queue.

In the NB direction, queues will back up into the intersection with East Street in both peak hours. This intersection is rather ambitiously channelized at present. A redesign at this location which removes some of the existing channelizing islands, but provides exclusive lanes for left- and right-turns from East Street, would improve operations here.

25g. Summary of Mitigation Measures

1) Grade Crossing Gates--installation of automatic gate crossing gates with lights and bells at all crossings in this segment.

2) Station area street improvements are:

   - striping of Route 3A EB at Summer Street to designate exclusive left-turn lane, channelization of Summer Street approach to Route 3A, and possible signalization if further field studies suggest that platooning will not provide sufficient gaps for exiting vehicles; and

   - redesign Hull/East Street intersection to simplify channelization, provide exclusive turning lanes to store NB traffic delayed by grade crossing closure. (See DEIS, Chapter IX, Figure IX-C24.)

3) Hingham Square grade crossings, following negotiation with Town officials, implement some or all of the following:

   - closure of South Place grade crossing;

   - closure of Main Street grade crossing, and alternative uses for space created on both sides of track; associated improvements to Central Street at North and South Streets; and

   - traffic signal installation at several locations (in addition to Main Street locations in the Square), including Hersey Street/South Street and North Street/South Street; and

   - channelization improvements at Hersey Street north of the track.

4) Hingham Square replacement parking--provision of off-street parking to replace the informal off-street parking lost on the railroad right-of-way and from any of the other street adjustments resulting in 3) above.

TABLE 25-1

Parking Movements, Main Street Parking Area
(August 5, 1987)

TIME (p.m.)	PARKED VEHICLES EXITING	ENTERING
4:00-4:15	12	12
4:15-4:30	12	12
4:30-4:45	13	11
4:45-5:00	5	5
5:00-5:15	12	6
5:15-5:30	13	7
5:30-5:45	7	6
5:45-6:00	9	4
TOTAL	83	63

TABLE 25-2

Observations of Exiting Delays: Summer St. SB (all directions)
(17 July 1987)

TIME (p.m.)	Average Exit Delay, sec.	Number of Observations
4:15-4:30	9.6	16
4:30-4:45	9.9	17
4:45-5:00	18.4	18
5:00-5:15	15.4	21
5:15-5:30	16.9	16
5:30-5:45	13.0	27
5:45-6:00	10.7	19
6:00-6:15	29.5	15
Overall Average Delay	15.1	149

TABLE 25-3

Level-of-Service Results
Nantasket Junction Intersections

				Level of Service: Year 2000 Traffic			
		Existing traffic		without Commuter Rail station		with Commuter Rail station	
Intersection	Signal-ized?	AM	PM	AM	PM	AM	PM
Current Conditions:							
Route 3A/Summer	NO	C-E*	A-E*	D-E*	A-F*	D-F*	A-F*
Route 3A/Kilby	NO			D-F*	A-F*	D-F*	A-F*
Washington Blvd/ Summer	YES			B	B	B	B
Washington Blvd./ Rockland	YES			B	B	B	B
With Mitigation:							
Route 3A/Summer	YES	--	--	--	--	B	B

* left turns from Route 3A EB into Summer or Kilby/left turns from Summer or Kilby SB into Route 3A

TABLE 25-4

Accident Incidence from Hingham Police Records

Intersection	Number of Recorded Accidents (1986)
Rockland St./Washington Blvd	4
Summer/Washington Blvd/Martin's Lane	5
Route 3A/Kilby	12
Route 3A/Summer	3
East/Kilby	7
East/Summer	2

TABLE 25-5

Estimated Grade Crossing Delays: Hingham Square Area

	PM Peak Hr. Approach Volume	Avg. 90-sec. Arrival (veh.)	Avg.Delay per stopped vehicle (sec.)	Total Stopped Vehicles per Pk.Hr.*	Avg.Total delay, all stopped veh. (min.)
1. Hersey Street					
--NB	190	5	50	15	12.5
--SB	167	4	49	12	9.8
2. Main Street					
--NB	191	5	50	15	12.5
--SB	212	5+	50	17	14.2
3. South Street					
--NB	313	8	53	24	21.2
--SB	210	5+	50	17	14.2
4. Water Street					
--NB	215	5+	50	17	14.2
--SB	186	5	50	15	12.5

*assuming 3 train passbys per peak hour

TABLE 25-6

Queuing Analysis:
Nantasket Jct. Station Area Grade Crossings

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Summer Street					
--NB					
AM Peak Hour	148	4	8	175	49
PM Peak Hour	91	2	5	110	47
--SB					
AM Peak Hour	81	2	5	110	47
PM Peak Hour	149	4	8	175	49
2. Kilby Street					
--NB					
AM Peak Hour	120	3	7	155	48
PM Peak Hour	130	3	7	155	48
--SB					
AM Peak Hour	114	3	7	155	48
PM Peak Hour	146	4	8	175	49
3. Hull Street (Route 228)[1]					
--NB					
AM Peak Hour	(145)	4	8	175	49
PM Peak Hour	(400)	10	15	330	55
--SB					
AM Peak Hour	(370)	9	14	310	54
PM Peak Hour	(430)	11	16	350	56

---

[1] Volumes approximate, based on 2 flanking count locations from Hull Center Study

TABLE 25-7

Distances to Nearest Intersections: Nantasket Jct. Area Grade Crossings

		Queue Conflict?	
	Distance	AM Pk	PM Pk
1. Summer Street			
--NB (Route 3A)	550′	NO	NO
--SB (Washington Blvd.)	1330′	NO	NO
2. Kilby Street			
--NB (Route 3A)	580′	NO	NO
--SB (Washington Blvd.)	(over .5 mile)	NO	MO
3. Weir Street			
--NB (Hull Street)	360′	NO*	NO*
--SB	(none within range)		
4. Hull Street (Rt. 228)			
--NB (East Street)	80′	YES	YES
--SB (Fisher Rd.)	280′	YES	YES

*if volumes comparable to Summer and Kilby Streets.

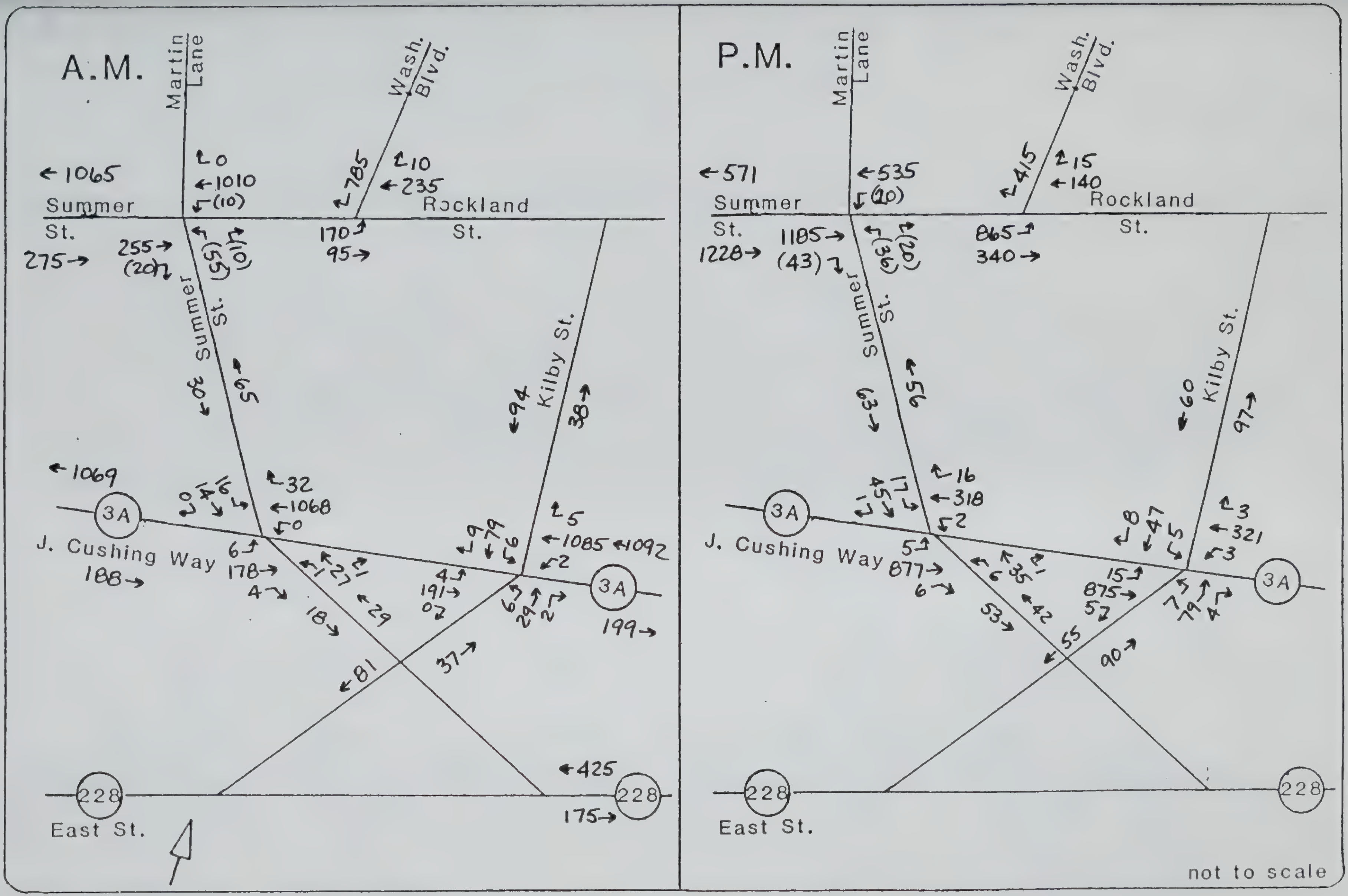

FIG. 25-1
GREENBUSH: Nantasket Junction
EXISTING TRAFFIC

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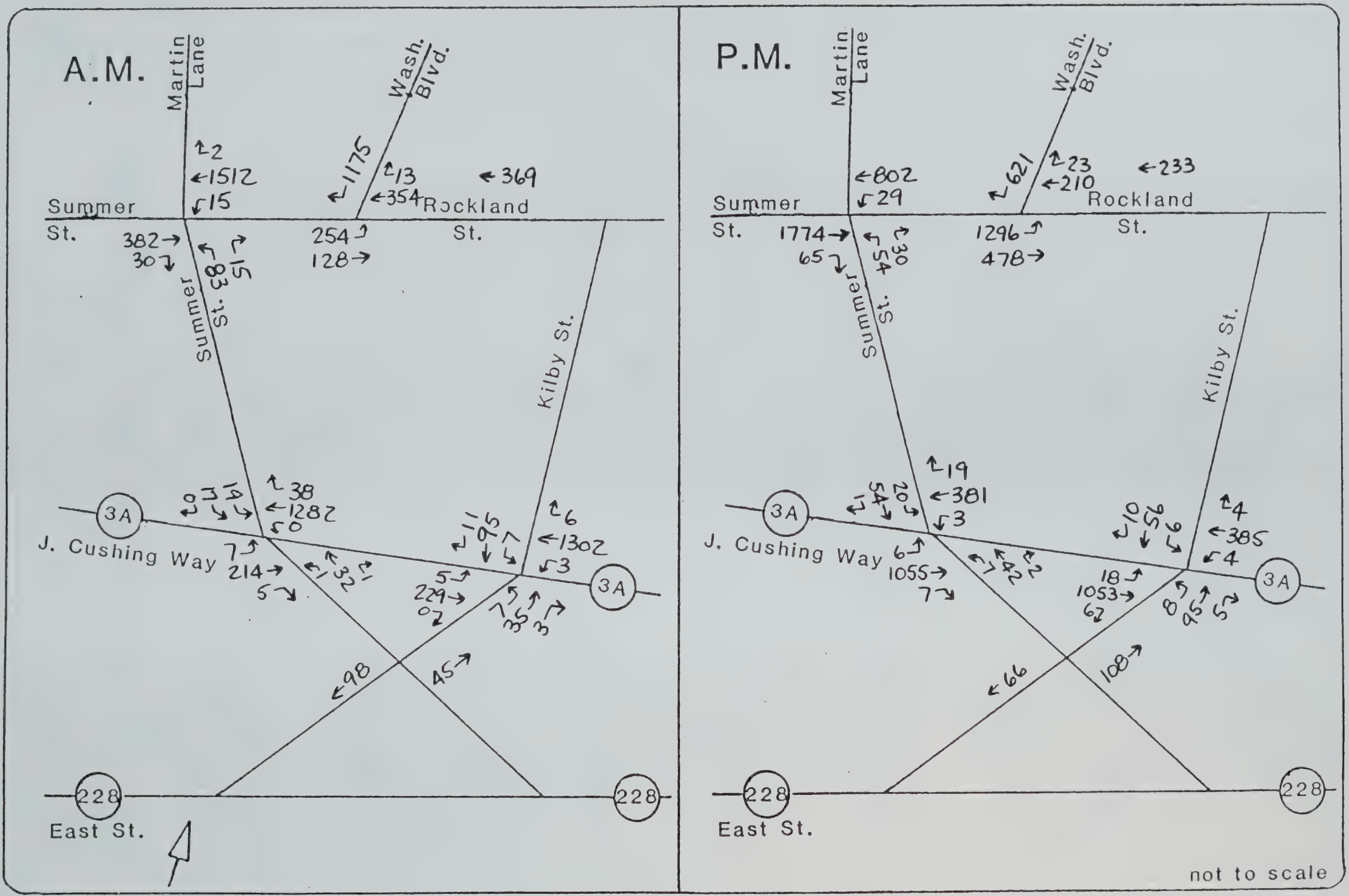

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

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FIG. 25-2
GREENBUSH: Nantasket Junction
YEAR 2000 BASE TRAFFIC

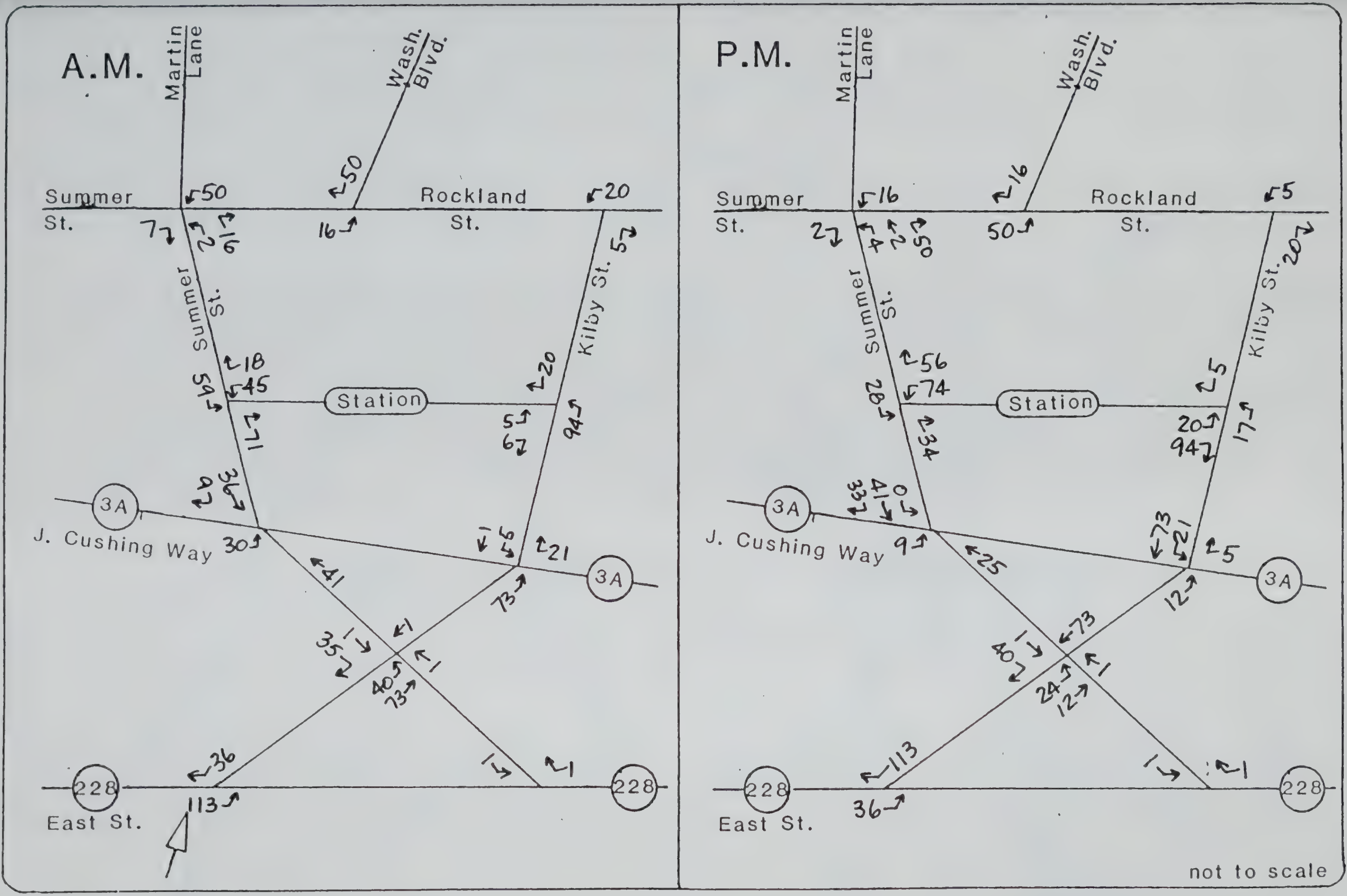

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FIG. 25-3
GREENBUSH: NANTASKET JUNCTION
Station Traffic

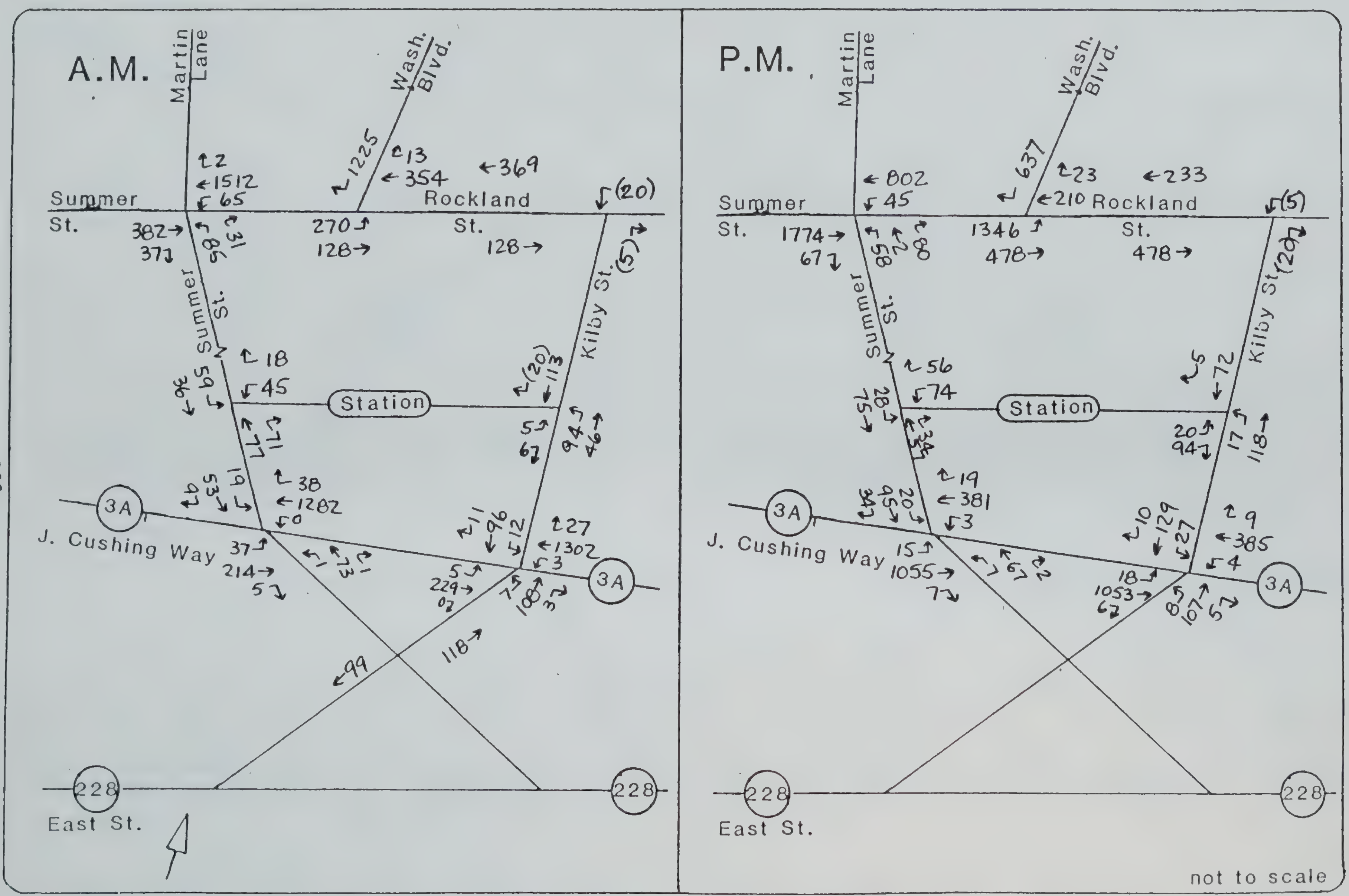

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FIG. 25-4
GREENBUSH: Nantasket Junction
FUTURE TRAFFIC, WITH STATION

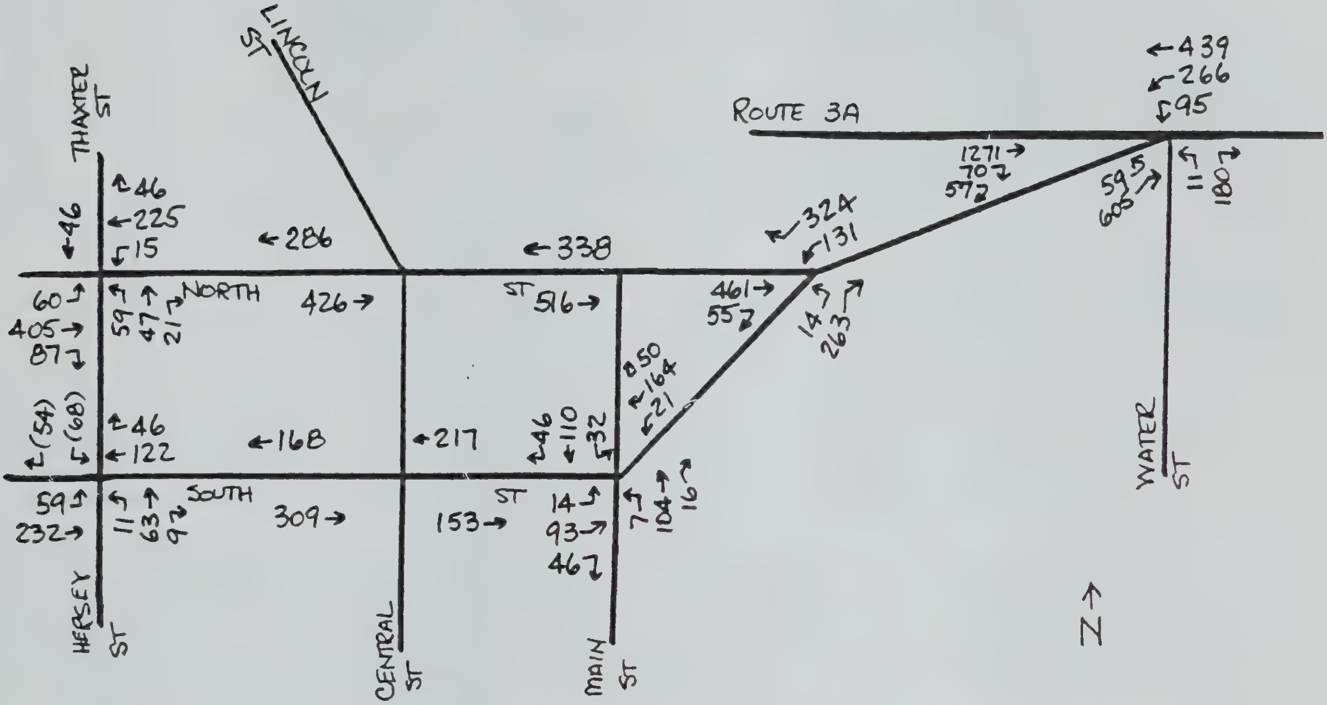


FIG. 25-5

EXISTING TRAFFIC VOLUMES, HINGHAM SQUARE AREA
(PM PEAK HOUR — 1987)

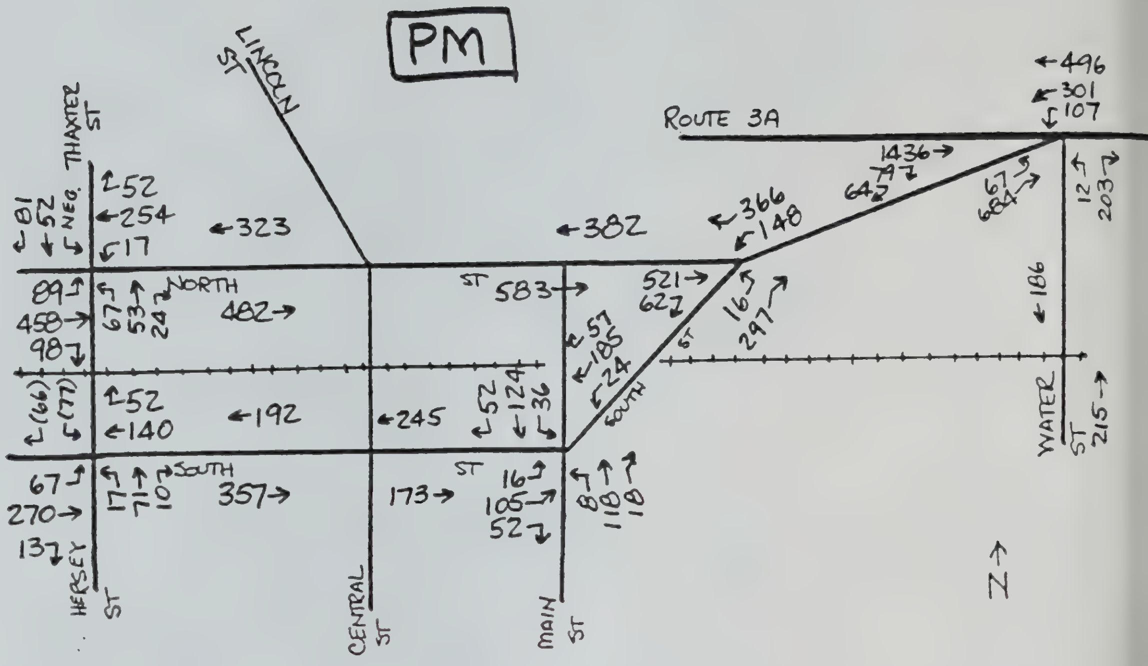


FIG. 25-6
HINGHAM
SQUARE
GRADE
CROSSINGS
(YEAR 2000)
-PM PEAK HOUR

Street	Hersey		Central		Main		South		Water	
	↓	↑	↓	↑	↓	↑	↙	↗	↓	↑
Direction	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
Available Distance	130'	15'	70'	70'	45'	55'	85'	240'	550' (170')	--
PM Hourly Volume	167	190			212	191	210	313	186	215
Avg.90-sec.Arrivals	4	5			5+	5	5+	8	5	5+
Queue Distance	88'	110'			110'	110'	110'	176'	110'	110'
Satisfied?	YES	NO			NO	NO	NO	YES	YES	YES
No. of "spillover vehicles"	--	4+	.	.	3	3	1	--	--	--
"Max" 90-sec.Arrivals	8	9			9+	9	9+	12	9	9+
Queue Distance	176'	200'			200'	200'	200'	265'	200'	200'
Satisfied?	NO	NO			NO	NO	NO	NO	YES	YES
No.of "spillover" vehicles	3	9			7	7	5+	1	--	--

26. Cohasset Station and Line Segment from Hingham-Cohasset Line to Cohasset-Scituate Line

This segment extends through the Town of Cohasset from the Hingham line to the Scituate Line on the Greenbush Branch and contains the Cohasset Station located off Route 3A west of its intersection with King Street. The primary street traffic impact within this section would result from station operations and from the nine public grade crossings, located in this segment.

26a. Streets and Intersections

The principal street serving the proposed Cohasset Station is Route 3A (Justice Cushing Highway), a 2-lane major arterial connecting Cohasset and Scituate with Hingham.

Route 3A in this location is 2 travel lanes wide, with wide shoulders and occasional left-turn lanes at busy intersections--notably at Sohier Street and at the Super Stop & Shop entrance at King Street east of Sohier. The posted speed limit on Route 3A near the station site is 45-50 mph, and observed travel speeds are high. Currently, there are traffic signals in place at the Super Stop & Shop entrance (paid for by the developer) and at Pond Street. In addition, the Super Stop & Shop developer is committed to adding traffic signals at Sohier and/or Lower King Streets, if these are deemed necessary within the next 5 years.

Forest Street/King Street is a residential street which provides the most direct connection between Cohasset and Hull. North Main Street is an extension of East Street, Hingham, It, too, is a residential street. The two streets are fairly narrow (22′-24′ paved width), without paved shoulders. Their intersection is controlled by a flashing red-yellow light and stop signs, with North Main having the right-of-way.

A proposal exists for the Mass. DPW to reconstruct the intersection of King Street and Justice Cushing Way (Route 3A), by straightening the King Street approach, regrading and improving the channelization at that location. This proposed rebuilding is not yet in the design stage, but may be speeded up if several development proposals planned for the area advance, as discussed below (Section 26d). In addition, this is one of the 2 locations where the Stop and Shop developer may be requested to install a traffic signal. Either of these improvements would also benefit the commuter railroad project.

In Cohasset Village, the track right-of-way crosses Smith Place, a short street which provides access to several small businesses, and Pleasant Street leading to Depot Court. Between these 2 streets the right-of-way is presently used for parking, and supplements the large town-owned lot adjacent to Depot Court. The streets serving Cohasset Village are narrow and closely spaced, with bays of angle parking on North Main and Pleasant Streets. On-street parallel parking is also permitted on some block faces, but because of the narrow streets and sidewalks, and lack of curbing for some sidewalks, vehicles park straddling the sidewalks.

Traffic though Cohasset Village generally moves slowly (as is appropriate for a historic town center). This is partly because of the narrow streets, irregular street patterns, and sight impedances due to parked vehicles.

26b. Traffic Volumes

Peak Hour turning movement traffic counts were conducted at several locations in this area: at North Main Street/Forest Avenue/King Street, at Justice Cushing Way/Sohier Street, and at the Justice Cushing Way/King Street intersection. Existing traffic volumes based on the counts performed in North Scituate Center are illustrated in Figure 26-1. In addition, traffic counts made in 1985, as part of the traffic study for Cohasset Plaza, were made available. These were compared and summarized to produce Figure 26-1, Existing Traffic.

Existing volumes on North Cohasset streets, apart from Route 3A, are low, and do not tax the available roadway capacity at present. Delays are experienced by vehicles exiting onto Route 3A at all unsignalized locations, however, because of high volumes traveling at high speeds on Route 3A.

26c. Accident Experience

Cohasset Police motor vehicle accident records were reviewed to determine accident incidence at critical locations in Cohasset, from the point of view of commuter rail operations. Table 26-1 summarizes reported accidents at these locations. The following observations were made from a review of the detailed accident data:

- Several of the accidents which occurred close to the center of Cohasset involved parking maneuvers, particularly vehicles backing out of angle parking spaces and hitting, or being hit by, other vehicles. Two of the "general Sohier Street" accidents also were, in fact, vehicle skirmishes in the South Shore Music Circus parking lot.

- The Forest/King/N. Main Street intersection is the scene of numerous accidents in which broadside collisions result from vehicles running the stop signs.

- Several rear-end collisions occurred at the Sohier Street approach to Route 3A, associated in part with long delays to traffic attempting to exit onto Route 3A.

26d. Future Growth Assumptions

Several development proposals are in the process of being formulated in the area of the proposed station. These include:

- Three office buildings on the south side of Route 3A, totalling 30,000 gsf. Access is proposed via a realigned King Street and Crocker Lane.

- An addition of 12 stores to the existing Stop & Shop Plaza at Route 3A/Sohier Street.

- A possible 128 units of moderate-income housing on Route 3A south of

King Street (adjacent to the Crocker office development).

These 3 proposals may generate on the order of 240 inbound and outbound trips in the PM Peak Hour in the immediate vicinity of the station area. This volume of added traffic is included over and above an assumed base growth rate of 1 percent per year, to produce a Year 2000 traffic base against which station volumes can be compared. This future base traffic scenario is as illustrated in Figure 26-2.

For these volumes, Levels of Service were calculated assuming (1) no traffic signalization at Lower King Street/ Justice Cushing Highway; and (2) traffic signal installation at this location, which we understand to be included in the Town's previous agreement with the Stop & Shop developer if triggered by traffic growth. The results of these calculations are presented in Table 26-2.

26e. Station Traffic

Patronage forecasts for a Cohasset location by mode of station access were produced for two rail alternatives, as described in Section B (Methodology). For purposes of the traffic analysis, forecasts for Alternative 3c, Middleborough and Greenbush Lines only, were used to determine vehicle attractions to the station.

Estimated daily boardings under this alternative were 205 park-riders and 111 drop-off patrons. Peak hour vehicle arrivals and departures under this scenario were estimated at 60 percent of daily arrivals, or 190 inbound and 67 outbound vehicle trips in the AM Peak Hour, with the reverse moves operating in the PM Peak Hour. All patrons were assumed to originate in Cohasset itself, with a distribution of arrivals as shown in Figure 26-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none were assumed to be local traffic already using local streets. For Cohasset, this is a particularly conservative assumption, because all station traffic is assumed generated locally, and most of this traffic would almost certainly be using Route 3A for commuter trips with or without a railroad station here.

The sum of Base Traffic and station traffic yields an estimate of total Year 2000 traffic volumes as depicted in Figure 26-4. These future volumes represent increases above Base 2000 traffic of approximately 5-30 percent, depending on location and time of day.

Level of Service for relevant intersections under future volume conditions are shown in Table 26-2.

26f. Grade Crossings

There are a total of twelve grade crossings in Cohasset, eight of which are public-way crossings. These are North Main Street, King Street, Sohier Street, Smith Place, Pleasant Street Spring Street in 2 locations, and Beechwood Street. Four are private crossings, at Rosano Lane, Sestito Lane, Castle Road, and Lincoln Lane.

Estimates were made of vehicle queues at locations where traffic count information was available, at North Main, King, and Sohier Streets. Smith Place essentially provides parking access for several businesses, and is not a through street. For other locations, likely queue lengths were estimated and compared with available street space to store queues. In Cohasset, as elsewhere, a 90-second gate closure per crossing and a maximum of 3 crossings per peak hour were assumed. Table 26-3 summarizes the results of this analysis.

At North Main Street, queues will not extend into any major intersection.

At King Street south of North Main, SB queues will frequently extend into the intersection with North Main/Forest Streets. At this location, a traffic signal with railroad pre-emption would serve several purposes: 1) it would provide for orderly traffic progression during train passbys, and 2) it would reduce the number of accidents at this location, particularly side-impact collisions caused by drivers running the existing flashing red light.

Sohier Street would not encounter grade crossing queues long enough to interfere with intersections during commuter peak hours. The street experiences its peak traffic conditions whenever the Music Circus is active--i.e., during summer months (roughly late June to late September) during evening hours. Weekday performances at the Music Circus generally begin at 8:00 PM, with no mid-week matinees. Typically there are 2 performances each weekend day, with the earlier beginning around 4:00 or 5:00 PM. The critical traffic period is immediately following the end of a performance, when the parking lot empties out all at once. Four police personnel are on hand to direct traffic at the end of performances, and reportedly the lot and street clear out in about 20 minutes, barring unusual circumstances.

Generally speaking, Music Circus activities will not coincide with the periods of peak commuter rail activity. During off-peak hours (after about 7:00 PM on weeknights), commuter rail would operate at frequencies of 2 hours or more between trains, and no weekend service is currently proposed.

While it is possible that an occasional late train may trigger the gate crossing on Sohier Street at the same time as the Music Circus departure time, this would happen quite rarely. On such occasions, a gate closure during a Music Circus discharge interval will operate as usual to stop vehicles in both directions for up to 90 seconds. Exiting Music Circus traffic heading for Ripley Road will be delayed, but traffic directed toward Route 3A will exit normally. Police details controlling traffic at the Music Circus exit can insure an orderly resumption of flow once the gates have lifted.

The Pleasant Street crossing is located adjacent to the Depot Court parking area in the center of Cohasset. The railroad right-of-way in this location runs behind several small commerical buildings, and is currently used for auxiliary parking. Reuse of the right-of-way for railroad operations will displace this parking, and activation of gate closures on the Smith Place, Pleasant Street, Spring Street and Beechwood Street crossings will cause short vehicle queues to develop.

The distances to intersections at Spring and Beechwood Streets are as shown in Table 26-4. Traffic counts were not available for these streets; consequently, an estimate was made of the threshold peak hour directional volumes for vehicle queues which remain clear of the intersection. These volume thresholds for each street are also shown on Table 26-4. The only locations where these volume thresholds are likely to be exceeded are on Spring Street NB from Cushing Road, and at the Spring St./Pond St. intersection. Both of these are low-volume locations, so that blockage here will not cause extraordinary delays or confusion.

26g. Mitigation Measures

The following traffic measures are recommended:

- Installation of grade crossing controls--installation of gate controls at all public-way crossings in Cohasset, with signage on private crossings.

- Installation of traffic signal at North Main/ Forest/King Streets, with railroad pre-emption.

- Station-related street improvements--provision of left-turn lane and right-turn deceleration lane at station driveway on Justice Cushing Highway; and coordination with MPW and Town of Cohasset regarding proposed redesign of Cushing Highway/King Street intersection. (See DEIS, Chapter IX-C25 and IX-C26.)

- Implementation of traffic control and off-street parking mitigation measures in Cohasset Village, following consultation with Cohasset officials. One conceptual scheme for such possible improvements is shown in the DEIS, Chapter IX, Figure IX-C27.

TABLE 26-1

Reported Accident Incidence, Cohasset Locations

(1) Location	(2) Total Number of Reported Accidents, May 1987-88	(3) Parking-maneuver accidents in (2)
Route 3A at:		
Harbor Lights Boatyard	2	--
Sohier St.	7	--
Sohier Street at:		
Ripley Road	3	--
(general Sohier St.)	5	1
North Main at:		
Cedar St.	3	--
Forest/King St.	11	--
Depot Court	2	--
(general No. Main St.)	6	1
South Main at:		
Elm St./Brook St.	6	1
Spring St./Summer St.	6	
(general So. Main St.)	7	2

TABLE 26-2

Level of Service Analysis: Cohasset Station Area Intersections

Intersection	Signal-ized?	Level of Service: Year 2000 Traffic without Cohasset Station AM	 without Cohasset Station PM	 with Cohasset Station AM	 with Cohasset Station PM
No. Main/King/ Forest St.	NO				
--all moves from King/Forest		B	D	D	E
Route 3A/Sohier St.	NO				
--left from 3A		D	C	D	C
--left from Sohier		E	F	E	F
No. Main/King/ Forest St.	YES	B	B	B	B
Route 3A/King St.	YES	B	B	B	C
Route 3A/Sohier St.	YES	B	B	B	B

TABLE 26-3

Queuing Analysis: Cohasset Grade Crossings

	Peak Hr. Approach Volume	Average" 90-sec. Arrival (veh.)	Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Dist. to Nearest Major Int. (ft.)
1. North Main St.					
--EB appproach					
AM Peak Hour	143	4	8	175′	(none)
PM Peak Hour	307	8	12	265′	
--WB approach					
AM Peak Hour	330	8	12	265′	(none)
PM Peak Hour	185	5	9	200′	
2. Lower King St.					
--NB approach					
AM Peak Hour	104	3	7	155′	1000′
PM Peak Hour	256	6+	10+	220+′	(Rt. 3A)
--SB approach					140′
AM Peak Hour	194	5	9	200′	(No.Main
PM Peak Hour	149	4	8	175	St.)
3. Sohier St.					
--NB appproach					415′
AM Peak Hour	77	2	5	110′	(So.Sho.
PM Peak Hour	175	4+	8+	175+′	Circus)
--SB approach					550′
AM Peak Hour	84	2	5	110′	(Ripley
PM Peak Hour	144	4	8	175+′	Rd.)
4. Pleasant St.					
--NB approach					
AM Peak Hour	121	3	7	155′	(none)
PM Peak Hour	137	3+	7+	155+′	
--SB approach					50′
AM Peak Hour	105	3	7	155′	(Depot Ct.
PM Peak Hour	130	3+	7+		pkg. area)

TABLE 26-4

Distances from Track to Intersections: Remaining Cohasset Grade Crossings

Grade Crossing Location	Nearest Intersecting Street	Approx. Distance from Track	"Threshold Volume",* veh./hr.
Spring Street (1)			
NB approach**	Spring St.	165′	140
SB approach	So. Main St.	470′	655
Spring Street (2)			
NB approach	Pond St.	30′	***
SB approach	So. Main St.	280′	310
Beechwood Street			
NB approach	N. Todd Rd.	665′	1,010
SB approach	So. Main St.	280′	310

* interpreted as the directional vehicle volume in either peak hour at which the 95th percentile arrival rate per 90-second interval would produce a queue that just reaches the nearest intersection.

** "threshold volume" probably would be exceeded by actual traffic volumes on this approach.

*** the Pond Street approach to Spring Street will be blocked by virtually all train pass-bys, because it is so close to the crossing.

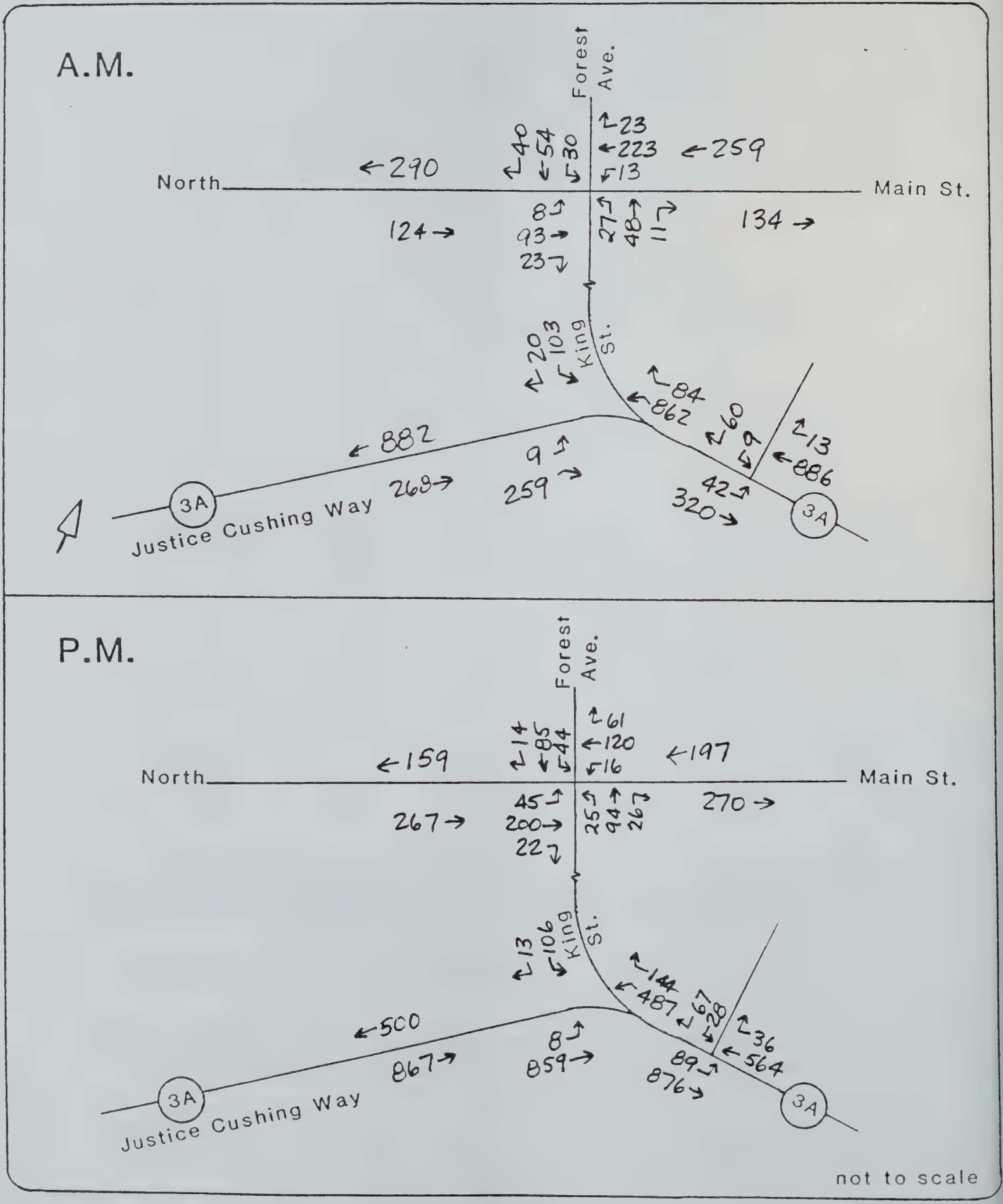


FIG. 26-1
GREENBUSH: Cohasset
EXISTING TRAFFIC

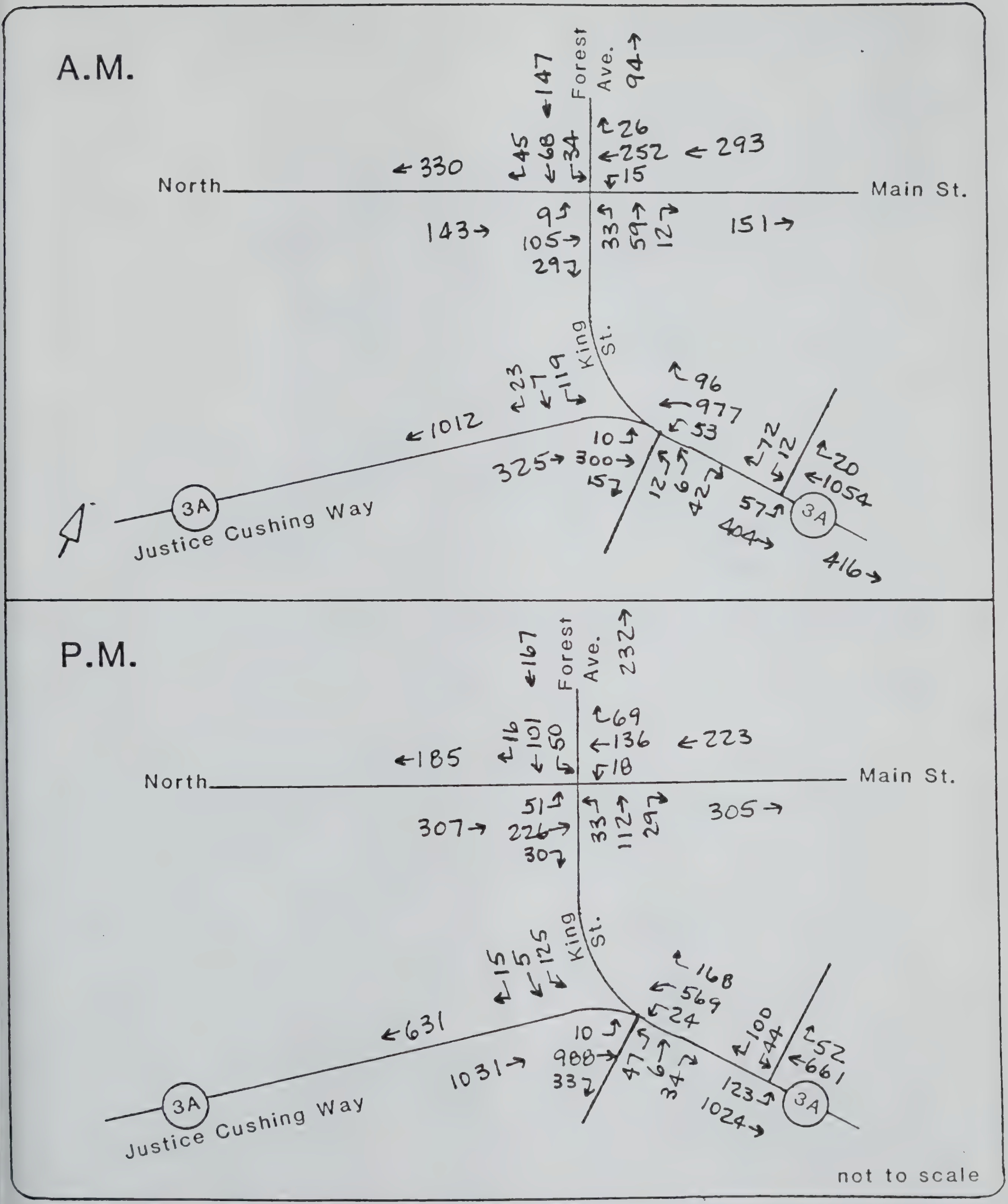
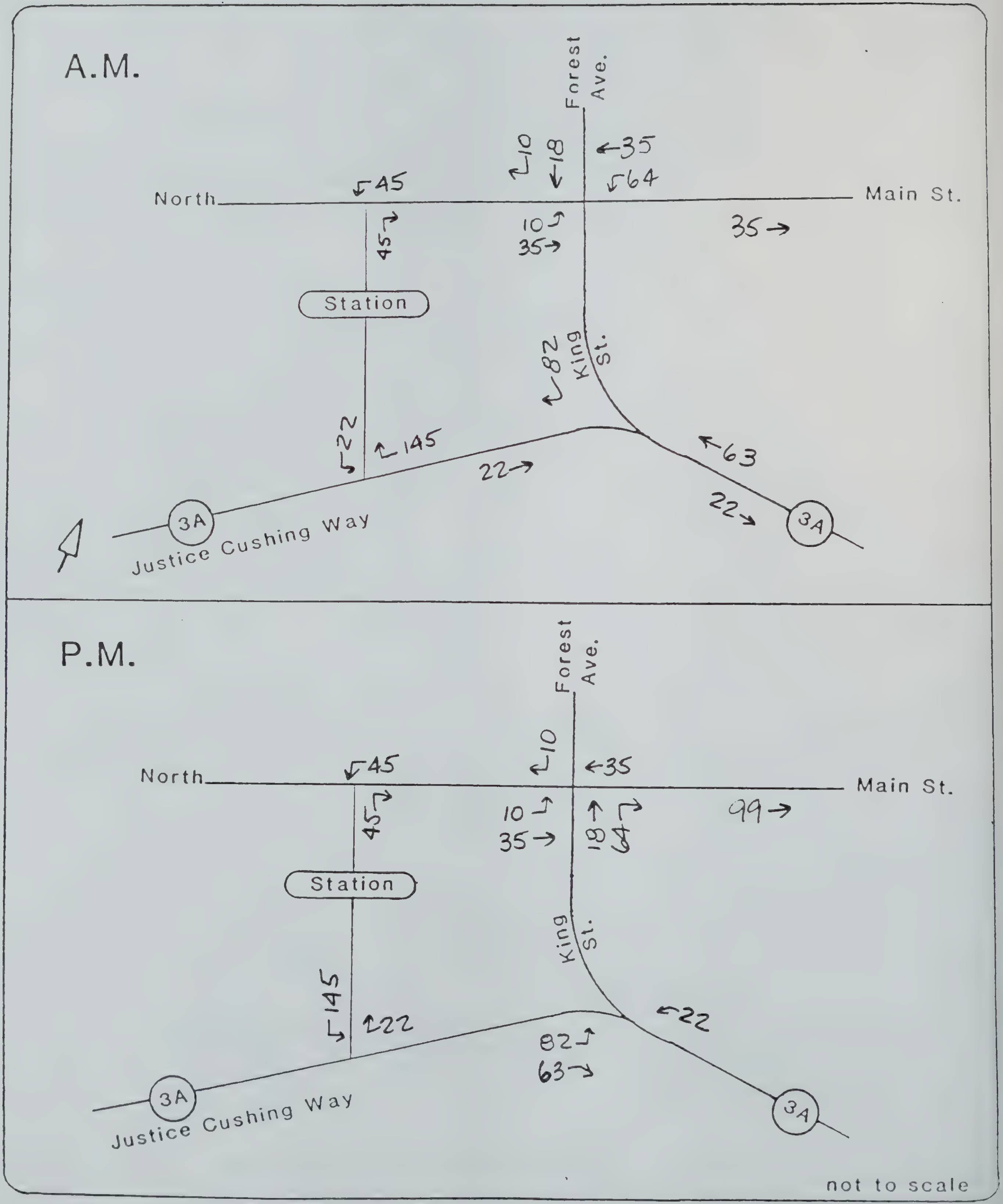
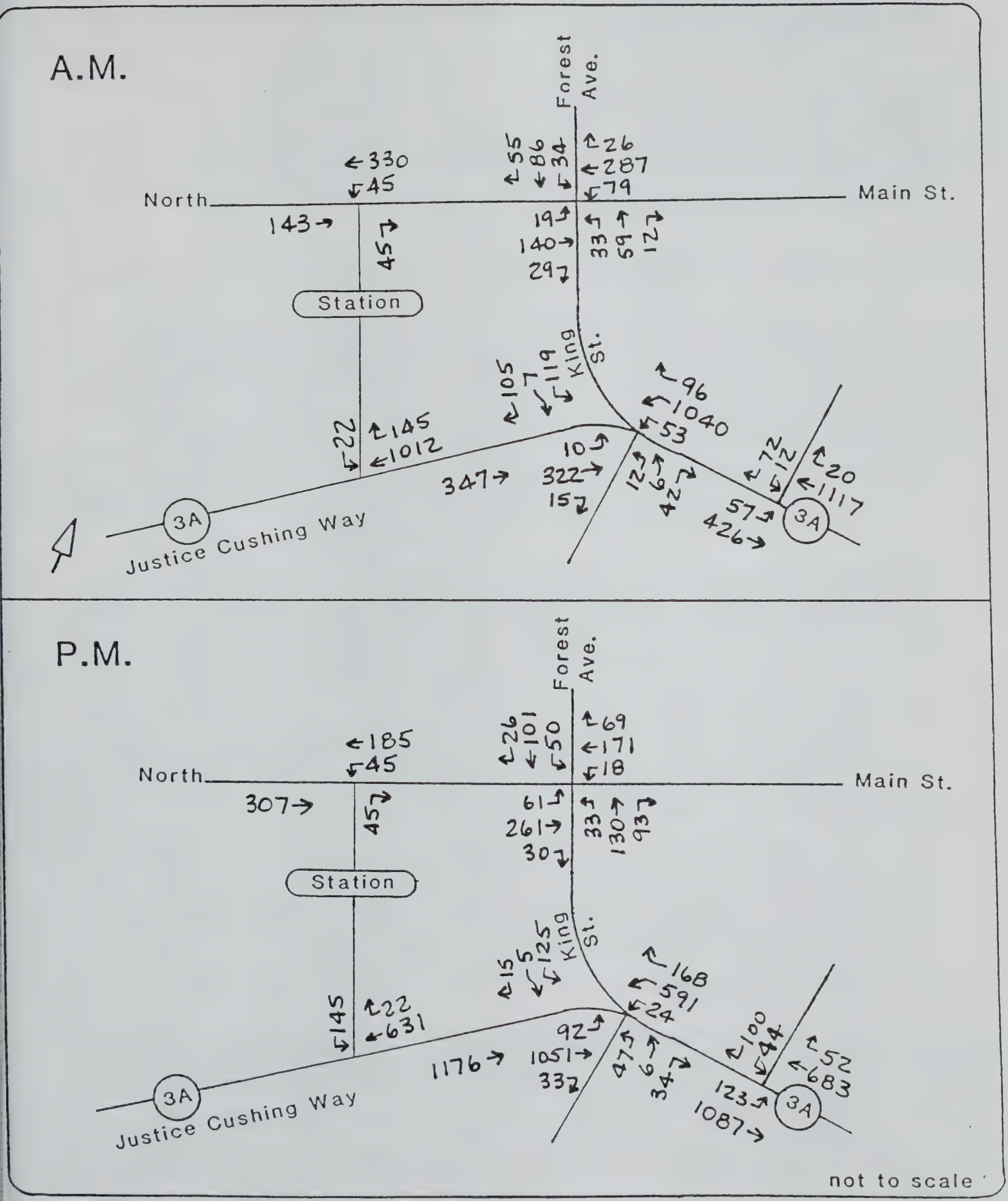


FIG 26-2
GREENBUSH: Cohasset
YEAR 2000 BASE TRAFFIC



not to scale

FIG. 26–3
GREENBUSH: Cohasset
Station- generated Volumes



MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

Old Colony Railroad
Rehabilitation Project

FIG. 26-4
GREENBUSH: Cohasset
FUTURE TRAFFIC WITH STATION

27. North Scituate Station and Line Segment from Cohasset-Scituate Line to Beaver Dam Road, Scituate

This segment extends from the Cohasset-Scituate town line to Beaver Dam Road in Scituate, on the Greenbush Branch. It includes the proposed North Scituate Station. The primary street traffic impact within this section would result from station operations. However, delays will be experienced at grade crossings, particularly at the Gannett Road/Country Way intersection.

27a. Streets and Intersections

For most of its length in this section, the railroad right-of-way traverses marshlands and crosses local streets which have light traffic volumes.

The principal street roughly paralleling the railroad is Country Way, a 2-lane roadway with dirt shoulders and no sidewalk which serves as a minor arterial providing local access within Scituate. Country Way meets Gannett Road in a 4-way intersection with Henry Turner Bailey Road, at North Scituate Center. This intersection is controlled by a fixed-time signal, operating on a 55-second cycle. This location is a complicated intersection, for several reasons:

- The railroad right-of-way crosses the intersection diagonally, although the traffic signal was installed in 1964 after rail service had been halted, and does not include railroad pre-emption.

- Booth Hill Road, a minor residential street of fair-to- poor quality, enters Country Way at an oblique angle and on a down-grade approximately 220 feet short of the Gannett Road/Country Way intersection.

- Just east of the intersection is the Gannett Road business district, which includes a general parking area in front of the former railroad station, now a package store. This parking area is striped, with 36 spaces located immediately adjacent to Gannett Road. Entrance/exit driveways are also striped; but because there is no curbing to separate this area from the street, parking access to/from Gannett Street is haphazard and uncontrolled.

- Other complications at the intersection include the random-access curb cuts accessing a former gasoline station, tennis courts, and the location of parking spaces in front of a bank, almost opposite Booth Hill Road. Vehicles leaving any of these spaces at the bank need to back out partly onto Country Way in order to exit.

27b. Traffic Volumes

Peak Hour turning movement traffic counts were conducted at two locations along this section, at Country Way/Gannett Road and at Mann Hill/Captain Pierce Road in Egypt. Existing traffic volumes based on the counts performed in North Scituate Center are illustrated in Figure 27-1

Existing volumes in this area are low, and can easily be handled by the amount of physical roadway space provided. Level-of-Service analysis of this intersection yielded Levels of "B" for both the AM and PM Peak Hours. However, some movements do tend to conflict, because of the awkward design elements listed above. This is only indirectly reflected in the LOS analysis procedures (e.g., assumptions about parking movements).

27c. Accident Experience

The Town of Scituate Police Department furnished us with information on accident incidence at key locations in the station area for 1986, the most recent year for which complete information is available. This information is summarized below:

Location	Number of Accidents
Route 3A/HT Bailey Road	6
Route 3A/Booth Hill Road	3
Gannett Road/Country Way	1

In past years, the Town requested that the Mass. Dept. of Public Works undertake improvements at the Route 3A/HT Bailey Road location, to eliminate the awkward existing channelization. No proposal for such improvements is currently being advanced, to our knowledge.

27d. Future Growth Assumptions

Several small-scale developments are proposed for the North Scituate area, but none on a scale which represents a major traffic addition. For purposes of the present analysis, assumed Year 2000 base traffic volumes, based on an area growth factor of 0.5 percent per year, were computed and are presented in Figure 27-2.

Level of Service Analysis was applied to the Gannett Road/Country Way intersection, assuming existing geometry and controls. The result was a continuation of LOS "B" for both AM and PM Peak Hours. This suggests that good-to-excellent operations will continue here with the low-to-moderate traffic growth expected, particularly if some of the less-than-ideal elements inherent in the present street layout can be rectified.

27e. Station Traffic

The North Scituate Station would be located to the northwest of the Gannett Road/Country Way intersection. Parking would be provided in three separate lots:

- South Shore Publishing Co. site with access off Country Way north of the intersection via a one-way driveway couplet.
- Tennis court site, with access off Henry Turner Bailey Road west of the intersection.

- Reserve site west of the railroad right-of-way and north of the station site, with access off Henry Turner Bailey Road west of the intersection.

Pedestrian connections between the reserve lot and the station would be provided across Henry Turner Bailey Road.

Patronage forecasts for a North Scituate station, by mode of access, were produced for two rail alternatives, as described in Section B (Methodology). For purposes of traffic analysis at this station, forecasts for Alternative 3c, Middleborough and Greenbush Lines only, were used to determine peak hour vehicle attractions to the station, since this was the alternative under which vehicular attractions to this station were highest. This resulted in an assumption of 209 daily parkers, 111 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 125 parking vehicles arriving AM, departing PM, and 67 drop-off vehicles entering and exiting the station (from Country Way) in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 27-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using the three streets near the station. In fact, however, the greatest number of boarders by all modes have origins in Scituate (68 percent), with smaller numbers attraacted from Norwell and Cohasset. It is more likely that some station traffic is traffic which would otherwise use local streets to access Route 3A or Route 123, and hence to commute out of town.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 27-4, represent increases above Base 2000 volumes of 10-28 percent, depending on location and time period.

Level of Service results for the Gannett Road/Country Way intersection volumes remain at "B" for both AM and PM Peak Hours. As a minimum improvement, though, the existing traffic signal in North Scituate Center would need to be replaced with a signal allowing for railroad pre-emption. Increased delays to all vehicular moves entering the intersection would occur with each train passby; but the maximum number of train passbys is likely to be only 3 per peak hour.

Level of Service at the proposed station entrance was also calculated, using the procedures appropriate for unsignalized intersections. This procedure produces different LOS evaluations for each critical move. At this location, the results were:

	Peak Hr.LOS Value	
	AM	PM
STATION ENTRANCE		
Left turns into driveway from Country Way WB	A	A
STATION EXIT		
Right turns from driveway onto Country SB	A	A
Left turns from driveway onto Country NB	A	A
ADDTIONAL PARKING LOT		
Left turns into driveway from Bailey WB	A	A
Right turns from driveway onto Bailey EB	A	B
Left turns from driveway onto Bailey WB	A	A

27f. Grade Crossings

There are four grade grossings in this segment: the Gannett Road/Country Way intersection, Hallett Stret, Mann Hill Road and Beaver Dam Road. The latter three are located on low-volume roads which are well-removed from any major intersection. At North Scituate Center, the grade crossing will affect traffic from all approaches, including the Booth Hill Road approach to Country Way.

With Old Colony commuter service through the Gannett Road/Country Way intersection commuter train passby is assumed to require a maximum gate closure of 90 seconds. The proposed schedule calls for half-hour commuter-train headways on the Greenbush Line during peak hours, with less-frequent service during off-peak hours. Consequently, a maximum of three train passbys per peak traffic hour are anticipated on this line.

Railroad pre-emption would be required in a new traffic signal installations at this location.

Table 27-1 illustrates the average and "maximum" vehicle arrival rates during a grade crossing closure. Given these arrival rates and an assumption of single-line approaches, the longest delays will be experienced in the evening peak hour, on the Bailey Road approach. In fact, however, a separate right-turn lane already exists on this approach, and right turns will be permitted to proceed even when the gates are down. Right turns from this approach represent over one-quarter of the total approach volume.

Because the intersection approach tapers down to a single lane on Bailey Road east of the intersection, the right-turn lane is blocked when the queue of left-turning or through vehicles is greater than seven. the average arrival rate for trough- or left-turning vehicles is 8 per 90-second passby; so that on almost half of all closings, queue build-up of stopped vehicles will not block the right-turn lane at all. the rest of the time, only 1 or 2 right-turning vehicles at most will be blocked by queued through and left-turn traffic; and these will be vehicles arriving at the end of a train passby, just before the gates open to permit normal traffic flow to resume. The auxiliary parking lot driveway itself may be blocked from time to time by grade crossing closures; but this should not represent a significant problem for exiting vehicles because train alighters will not reach vehicles parked in this lot before the train departure.

On Gannett Road WB approach, the maximum queue length is some 308 feet. One available lane for queuing is assumed here. It would be difficult to channelize this approach to allow gate installation for through moves while permitting right turns to proceed, without reducing the existing sidewalk width. Consequently, it assumed that all traffic is blocked by a train passby on this approach.

On the Country Way approach, the maximum likely queue length would reach beyond the Booth Hill Road left-turn leg. Consequently, several Booth Hill Road vehicles turning left onto Country Way may, under maximum-likely queuing conditions, be blocked briefly before making the turn. This situation can be ameliorated by realigning the Booth Hill left-turn approach to Country Way, so as to bring it closer to the existing right-turn channel, entering Country Way at a right angle. This is an improvement already being implemented by the Town of Scituate.

27g. Mitigation Measures

The following traffic measures are recommended:

- Installation of grade crossing controls--installation of gate controls on all 4 approaches to Gannett/Country Way intersection. This will include location of a channelizing island on the current channelizing paint markings on Bailey Road EB, to permit unrestricted right turns.

- Replacement of existing traffic signal--review existing signal installation. Incorporate railroad pre-emption. Insure adequate operation of pre-emption sequencing. Adjust phasing to permit Bailey Road right turns to proceed while pre- emption is activated. (Existing phasing for non- preemption sequencing appears to be appropriate for future traffic conditions, but timing needs minor adjusment).

- Street improvements--realign Booth Hill Road approach to Country Way to provide right-angle connection, with stop-sign control.

A conceptual plan for street improvements is shown in the DEIS, Chapter IX, Figure IX-C29.

TABLE 27-1

Queuing Analysis: North Scituate Center Grade Crossing

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. Gannett Road WB					
AM Peak Hour	412	10	15	330	55
PM Peak Hour	360	9	14	310	54
2. Henry Turner Bailey Road EB					
AM Peak Hour	153	4	8	180	50
PM Peak Hour	434	11	16	350	56
3. Country Way NB					
AM Peak Hour	355	9	14	310	54
PM Peak Hour	323	9	13	285	53
4. Country Way SB					
AM Peak Hour	157	4	8	180	50
PM Peak Hour	370	9	14	310	54

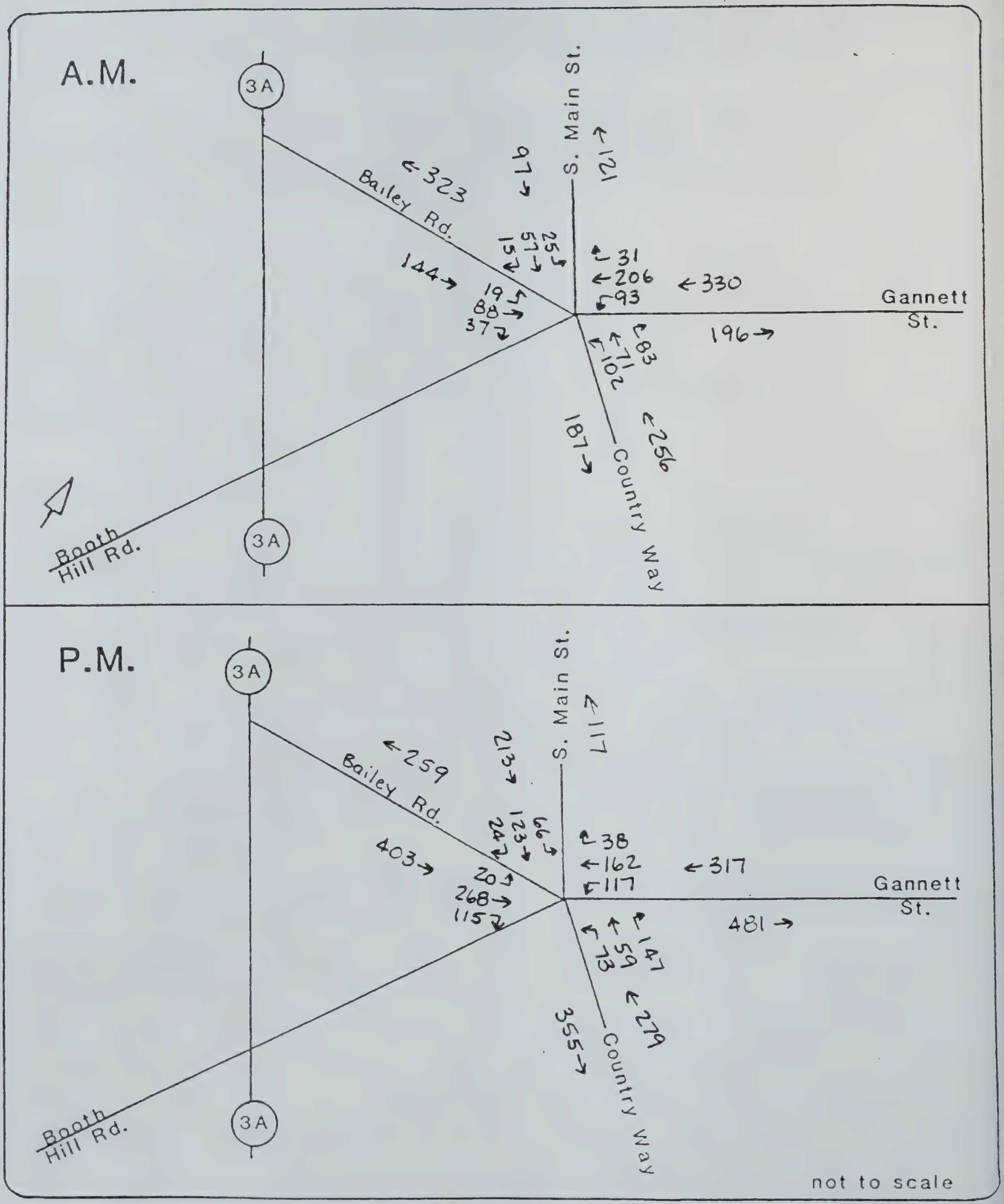


FIG 27-1
NORTH SCITUATE:
EXISTING TRAFFIC

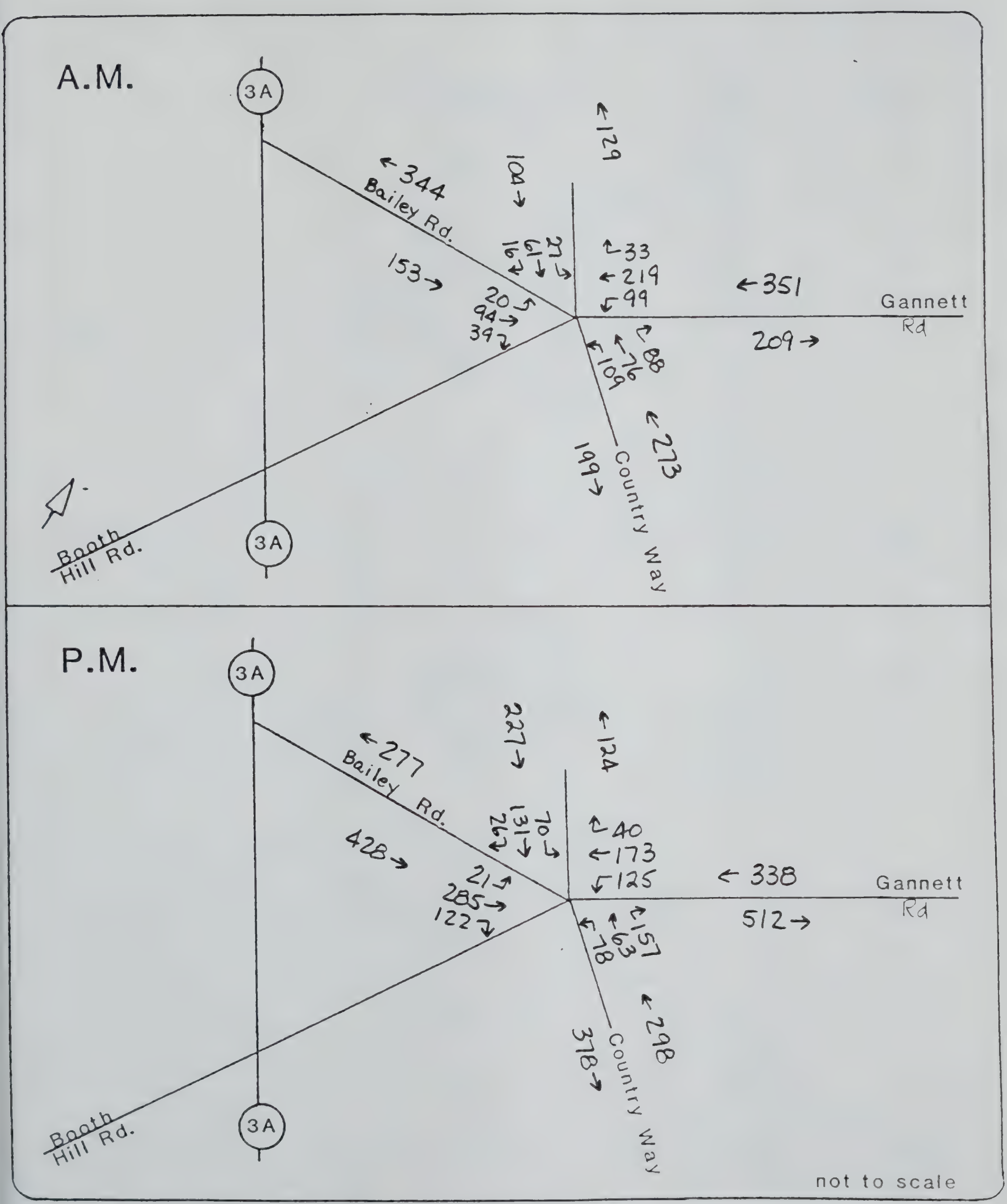


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FIG 27-2
NORTH SCITUATE:
YEAR 2000 BASE

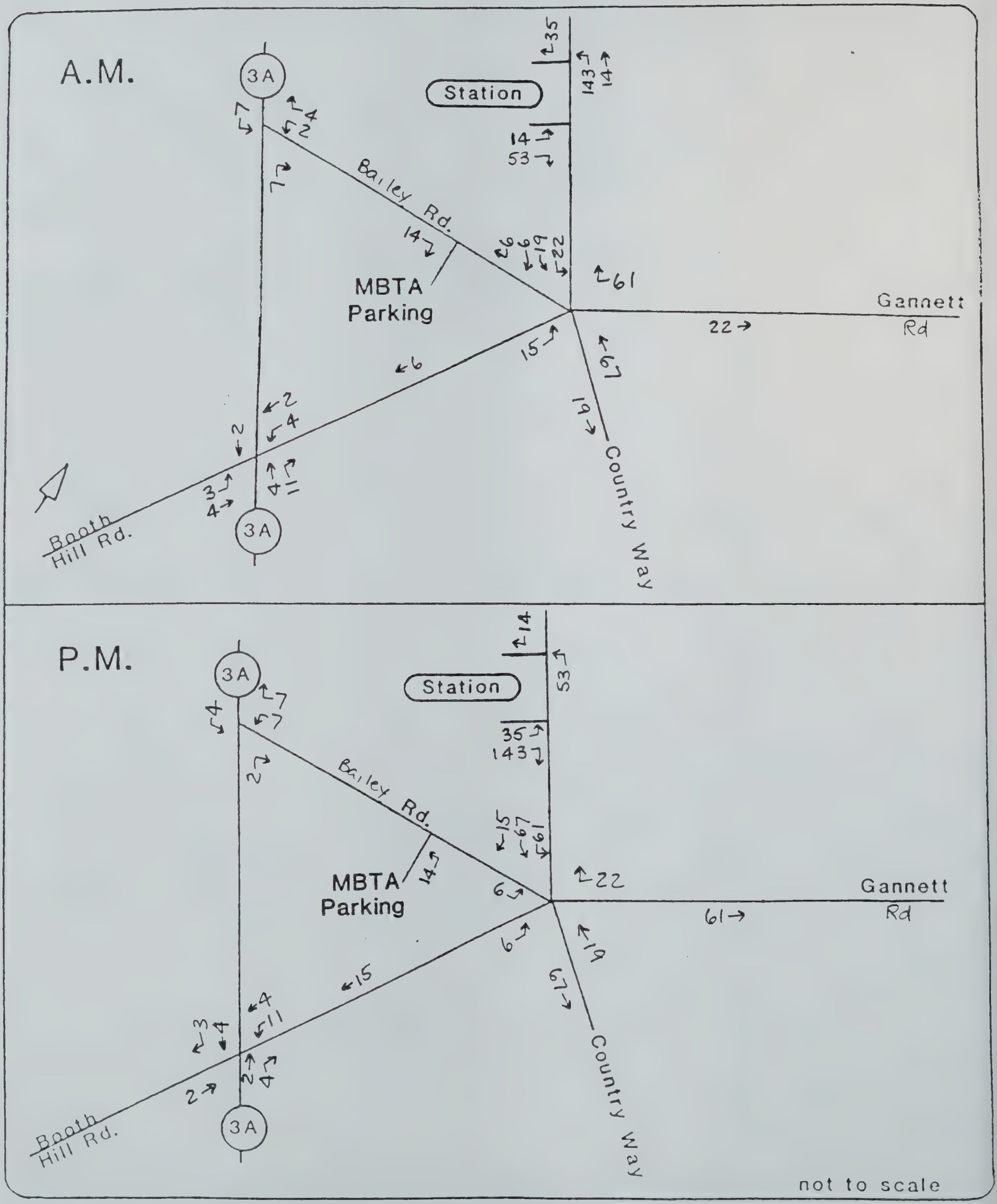

FIG. 27-3
NORTH SCITUATE:
STATION TRAFFIC

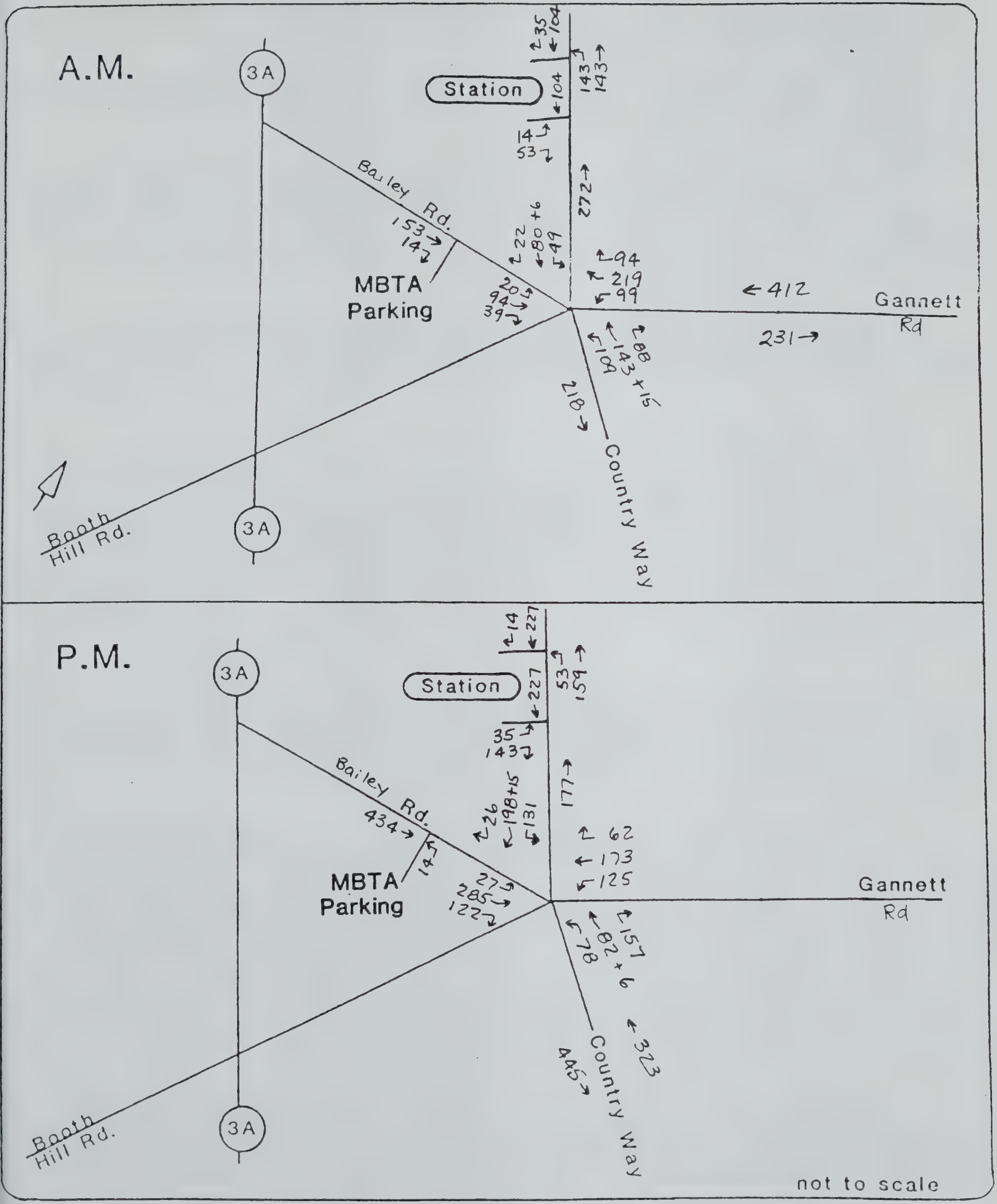

FIG. 27-4
NORTH SCITUATE:
FUTURE TRAFFIC

28. Greenbush Station and Line Segment from Beaver Dam Road to North River, Scituate

This segment extends from Beaver Dam Road in Scituate to the North River, on the Greenbush Branch. A station location is proposed for the end of the line, with direct access to the Old Driftway, between the New Driftway and Stockbridge Road.

In addition to the grade crossing at Beaver Dam Road, this segment also includes a crossing at First Parish Road. If a layover facility is located south of the New Driftway, this will also create an active grade crossing; but this crossing would only be used at the beginning and end of each day, as trains move in and out for the daily schedule.

The primary traffic impact within this section would occur in the vicinity of the proposed station site, and at the nearby intersections of Country Way/New Driftway and Old Oaken Bucket Road/Route 123/Route 3A.

28a. Streets and Intersections

The principal street providing station access will be the New Driftway, a 2-lane minor arterial of good quality for most of its length, which provides access to the lower coastal areas of Scituate. Considerable development has taken place along the street in recent years, and several development proposals are pending close to the proposed station site; so that although the density of activity along the Driftway remains low for the present, it is likely to increase steadily for the foreseeable future. Most of the new development is commercial or multi-family residential.

Country Way is a town-owned street which roughly parallels Route 3A through Scituate, providing internal connections between Scituate activity centers. In the vicinity of the station site, it is a narrow 2-lane roadway, predominantly residential in character. Station access from Country Way is via Stockbridge Road and the Old Driftway.

Country Way and the New Driftway intersect close to Route 3A and to the intersection of Country Way and Old Oaken Bucket Road. This entire area is an awkward arrangement of intersecting roads in which conflicting moves abound, right-of- way is inappropriately assigned, and there is little room to store queued turning movements separately. The arrangement of street connections, and the unorthodox assignment of stop-sign right-of-way at this location, resulted from a roadway improvement process which over the years added piecemeal to the area's historic roadway pattern with short sections, instead of incorporating the set of roadway linkages into a comprehensive new design. The resulting pattern is confusing to unfamiliar drivers, and difficult to negotiate even for local residents.

The intersection of Route 3A with Old Oaken Bucket (OOB) Road and Route 123 is signalized, and appears to operate without significant delay to vehicles approaching on any leg. The difficulties experienced by vehicles approaching the signal on the OOB westbound leg are caused by roadway geometry, as described above, not by lack of signal capacity. Similarly, on the west side of Route 3A, the Route 123 (Stetson Road) approach to the highway is complicated by OOB Road EB, which enters Stetson Road on a downgrade and at an oblique angle, with stop sign control. Traffic on Old Oaken Bucket Road cannot be seen by right-turning vehicles on Route 3A SB; as a result, no right- turn-on-red is permitted from Route 3A SB at present.

Route 3A is a state-owned roadway, 1 travel lane in each direction with variable-width shoulders, widening to 2 lanes at at-grade intersections. Although the road is not limited- access, major driveways and intersections are fairly infrequent on Route 3A, and the speed limit in this section is 50 mph.

28b. Existing Volumes

Traffic volumes in this area of Scituate were determined from previous counts performed in 1986, in connection with the Herring Brook Place development project on the New Driftway.[1] The study performed for that project noted that improvements to the Country Way/Driftway intersection have been proposed, and are at the conceptual design stage.

Existing (1986) traffic volumes are displayed on Figure 28-1. As that Figure suggests, traffic volumes in the area are currently not high, and can easily be accommodated by the amount of available pavement. Level of Service analysis applied to the Route 3A/Route 123/OOB Road intersection, given existing approach widths, yields LOS "B" for both AM and PM Peak Hour volumes. This analysis does not reflect the left-turn conflicts and queue lengths for EB traffic noted above.

28c. Accident Data

The Town of Scituate Police Department provided us with summaries of accident data at key locations for the most recent year for which complete data was available (1986). The numbers of accidents at this location were as follows:

Location	Number of Accidents
Driftway/Old Driftway	4
Stockbridge Road/Old Driftway	2
Stockbridge Road/Country Way	5
Route 3A/Route 123	7

---

[1] BSC Engineering, Traffic Impact Assessment, Herring Brook Place Proposed Retail Center, Scituate, Mass., March 1986.

28d. Future Growth Assumptions

The principal development projects undertaken in this area in recent years include the following:

- Herring Brook Place, 32,500 sq.ft. of retail development, on the New Driftway west of the Old Driftway intersection, now open.
- James Landing, 50 units of residential condominiums on the New Driftway, under construction, now open.
- Fox Ridge Run, a residential subdivision of 11 single- family lots, west of Route 3A with access from Judge Cushing Road.

More recently, additional development proposals have included:

- A 10,000 sq. ft. office building adjacent to the railroad track on the northerly side of New Driftway (opposite the proposed warehouse driveway).
- A 10,600 sq.ft. warehouse facility, on the southerly side of the New Driftway, west of the railroad track.
- Warehousing facilities (10,000 and 20,000 sq. ft.) on the Old Driftway (including one which would occupy the proposed railroad parking area on the west side).
- Miscellaneous small commercial expansions on Country Way between Stockbridge Road and the New Driftway.

In addition, a 100-acre site located on New Driftway east of the Old Driftway is owned by the Town, and under current zoning could support 200 single-family homes. The Town has identified this area as a possible candidate for rezoning to uses of higher assessed valuation, as part of a strategy to diversify Scituate's tax base. No formal plan for the area has been developed as of this writing.

Because the rate of new development in this area is expected to be moderate-to-high, a traffic growth factor of 2 percent per year uncompounded was assumed to Year 2000, to serve as a base on which to add station traffic.

This assumed 2 percent per year growth, shown on the traffic "Base Case" diagram for Year 2000 (Figure 28-2) may, in fact, adequately estimate all pending development in the area. However, a separate trip generation was performed for the developments listed above as most recently pending, as a "sensitivity analysis", in order to determine how much difference these specific developments make in the traffic loadings in the station area. The results of these calculations are shown in Table 28-1.

The resulting future Base Traffic Volumes are displayed on Figure 28-2.

Level of Service analysis was applied to the Route 3A/Route 123/Country Way intersection, given these future volumes. The resulting LOS values for AM and PM Peak Hours remained at "B". Average queue length on intersection approaches is one of the outputs of this procedure; for AM and PM Peak Hours, the average queue lengths on the OOB approach were 3+ and 2+ vehicles respectively.

At this level of traffic demand, the awkward geometry of the Country Way/New Driftway intersection and OOB Road WB approach to Route 3A will become more constraining than it is at present, because queues will be longer and intersection blockage more frequent. This has already been recognized by the Town, which has in the past developed its own conceptual designs for realignment of the road segments in this area.

28e. Station Traffic

A commuter rail station located on the Old Driftway, where the original terminus of the rail line was located, would occupy the site of the present P & B bus storage facility. This would also be a terminal station.

Patronage forecasts for a Greenbush terminal station, by mode of access, were produced for 2 rail alternatives, as described in Section 2 (Methodology). For purposes of the traffic analysis, forecasts for full commuter rail service on the Middleborough and Greenbush lines only were used to determine peak hour vehicle attractions to the station, since this is the alternative which generates the highest traffic at Greenbush. This assumption resulted in estimates of 653 daily parkers, 247 daily drop-offs.

Peak hour vehicle arrivals and departures under this scenario are estimated at 60 percent of daily arrivals; or 392 parking vehicles arriving AM, departing PM, and 148 drop-off vehicles entering and exiting the station in each peak hour. The distribution of arrivals, based on towns of origin, are as shown on Figure 28-3.

To be conservative, all station volumes were assumed to be net additions to existing traffic; none are assumed to represent local traffic already using local streets.

Total Year 2000 traffic volumes with a commuter rail station, as depicted in Figure 28-4, represent increases above Base 2000 volumes of up to 40-45 percent on the New Driftway and on Country Way.

Level of Service Analysis of the principal intersections close to Route 3A yielded results as shown in Table 28-1. The major impact of station traffic will be experienced at the unsignalized intersection of Country Way and Route 3A, just south of the Route 3A/Route 123 signal, particularly during the PM Peak Hour. This leg of Country Way presents the most direct exit route for southbound traffic; but the large volumes of left-turn traffic associated with the station would overwhelm this intersection.

Two alternative design schemes were also analyzed, with the results presented in Table 28-1. The first is a design which is consistent with previous

Town-developed designs for the intersection. It includes the following elements:

- Realignment of the short section of connector roadway between New Driftway and Country Way, to provide a more direct link between the New Driftway and Route 3A.

- Minor widening on the New Driftway approach to Country Way.

- Designation of the New Driftway as the major street, with stop-signs relocated to Country Way.

- Traffic signalization of the Country Way/New Driftway intersection, via a coordinated system which ties in with the Route 3A/Route 123/New Driftway signal.

The second scheme includes the following additional elements:

- Elimination of the OOB Road connection to Country Way, and the triangular island which separates OOB and Country Way.

- One-way inbound operation of Country Way between Route 3A and New Driftway; all left turns onto Route 3A now made at Route 128 signal.

Under this latter scheme, the difficult left-turn from Country Way onto Route 3A is eliminated, at the cost of increased delays at the at the Route 3A/Route 123 intersection. This is illustrated in Table 28-1, where LOS drops at the Route 3A/Route 123 intersection for Alternative 2 because of the large left turn volume which has been diverted from the Country Way approach to Route 3A.

In addition, improvements would be undertaken at the intersection of the Driftway and Old Driftway. These would include widening of Driftway to provide a left-turn storage lane, and channelization on Old Driftway. Analysis of operations under the Year 2000 case with the station does not indicate that signalization would be needed here immediately; at some future point, however, traffic volume increases may result in conditions which meet traffic signal warrants at this location.

Finally, improvements will also be required at the intersection of Old Driftway and Stockbridge Road. Traffic volumes are low; however, because of the steep grades on the bridge approaches, sight distances for left turns out of Old Driftway are barely adequate (about 160 feet). A restricted speed limit of 20 mph is posted over the bridge. Also, additional signing, and pavement marking on all approaches in this location, would be required in conjunction with rail operation.

28f. Grade Crossings

Of the three potential grade crossings in this section (Beaver Dam Road, First Parish Road, and (to service a layover facility) New Driftway, traffic counts were available for two. Beaver Dam Road is believed to carry traffic volumes which are comparable to First Parish Road, except that there are no nearby intersections on Beaver Dam Road. Consequently, the analysis performed for First Parish Road was assumed to apply also to Beaver Dam Road.

With Old Colony commuter service through Scituate, a commuter train passby is assumed to require a maximum gate closure of 90 seconds. The schedule currently envisaged calls for half-hour commuter-train headways on the Greenbush Line during peak hours. Consequently, a maximum of 3 train passbys per peak traffic hour are anticipated on this line.

Table 28-2 illustrates the average and "peak" (95th percentile) vehicle arrival rates at the railroad track in both AM and PM Peak Hours for First Parish Road, based on traffic counts factored up to Year 2000 at 2 percent average annual growth (uncompounded). The New Driftway was subjected to the same analysis; however, if a grade crossing is located here in connection with line operations, it would be active only for a brief period at the beginning and end of the day, and would not impact either AM or PM Peak hour traffic.

The distance between the railroad right-of-way and Elm Street, along First Parish Road, is about 165 feet. The maximum queue length under peak arrival conditions will extend back beyond the Elm Street entrance to First Parish Road. The Elm Street arrival rate in the PM Peak Hour is 45 vehicles, or slightly more than 1 per 90 second period; so that, on average, 1 arriving Elm Street car may be temporarily blocked from entering First Parish Road during a train pass-by.

The Beaver Dam Road crossing is at a location where grades are steep and sight distance is inadequate. Town officials have requested special signing of this grade crossing at the top of the hill, some distance away from the track, as a safety measure, with which we concur.

28g. Mitigation Measures

The following traffic measures are recommended:

- Grade crossing controls--installation of full gate controls at grade crossings. Signing at Beaver Dam Road crossing in advance of the hill approach, as a special safety measure.

- Intersection redesign at Route 3A/Route 123-- implementation of proposed redesign scheme, as described in Section 4 above, if approved by Town and Mass. Dept. of Public Works. Installation of coordinated traffic signals at Route 3A/Route 123 and New Driftway/Country Way.

- Redesign of intersection at New Driftway/Old Driftway to provide left-turn lane on New Driftway EB, with adequate queue storage. Repaving, realignment, and other minor improvements to Old Driftway approach to New Driftway.

- Intersection improvements at Stockbridge Road/Old Driftway--barring the likelihood of major bridge reconstruction, additional signage and pavement markings or channelization would be added to reduce ambiguity and provide adequate warning of sight distance limitations.

Conceptual plans for the improvements at Route 3A and at the Driftway/old Driftway intersection are shown on the DEIS, Chapter IX, Figures IX-C30 and IX-C31.

TABLE 28-1

Trip Generation for Possible Future Development
Greenbush Station Area, Scituate

Assumed Development Alternatives*	Peak Hour AM	Peak Hour PM	TOTAL DAILY
Single-Family Housing, 200 units	152	209	1,959
Warehouse, 10,000 gsf	83	7	379
Storage, 10,000 gsf	1	2	22
Storage, 20,000 gsf	2	5	45
Office, 10,000 gsf	28	29	244
	266	252	2,649

TABLE 28-2

Level of Service Analysis:
Route 3A/Route 123 Area Intersections

		Level of Service: Year 2000 Traffic with Station					
		Existing Design		Alt. 1		Alt. 2	
Intersection	Signalized?	AM	PM	AM	PM	AM	PM
Route 3A/Route 123/ OOB Road	YES	B	B	B	B	D	D
Country Way/N.Driftway	NO						
Lefts from major street		A	A	A	A	A	A-B
Moves from minor streets		B-C	D-E	B-D	D-E	A-E	B-E
Country Way/N.Driftway	YES	--	--	D	D	D	D
Country Way/Route 3A	NO						
Lefts onto Route 3A		E	F	F	F	(n/a)	(n/a)

TABLE 28-3

Queuing Analysis: Greenbush Segment Grade Crossings

	Peak Hr. Approach Volume	Average 90-sec. Arrival (veh.)	"Peak" 90-sec. Arrival (veh.)	Peak Queue Length, (ft.)	Avg.Delay per stopped vehicle (sec.)
1. First Parish Road					
--EB					
AM Peak Hour	156	4	9	200	49
PM Peak Hour	297	8	13	285	53
--WB					
AM Peak Hour	166	4	9	200	49
PM Peak Hour	263	7	12	265	52
2. Driftway*					
--EB					
AM Peak Hour	491	12	17	375	57
PM Peak Hour	513	13	18	395	58
--WB					
AM Peak Hour	411	10	15	330	55
PM Peak Hour	638	16	21	460	61

*NOTE: Values are presented for the New Driftway to provide a basis of comparision with First Parish Road. It is not anticipated that a New Driftway grade crossing would be active at all during AM or PM Peak Hours; so that "maximum likely queuing conditions" would never arise in practice.

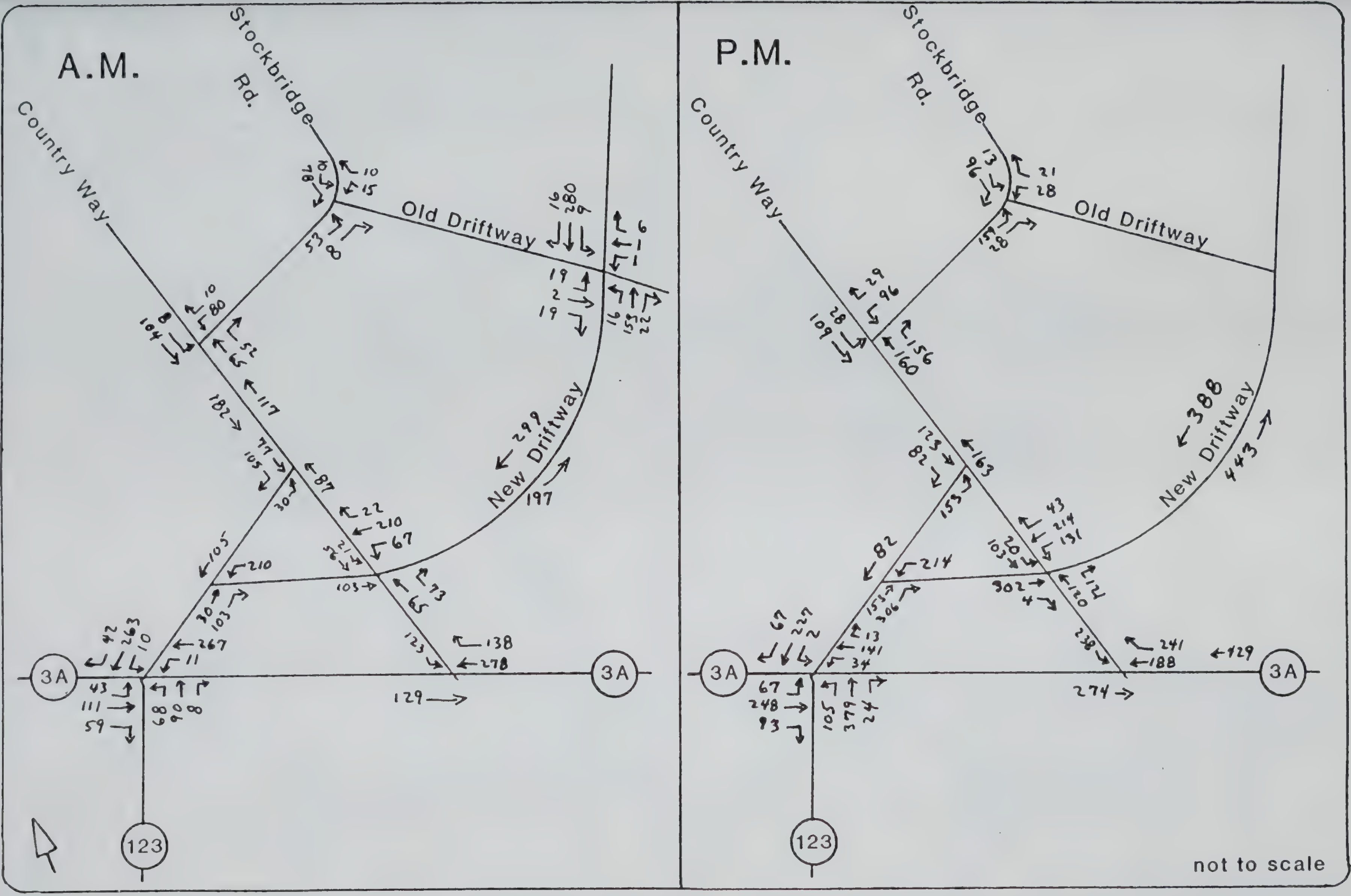

Fig. 28-1
Existing (EST) 1988

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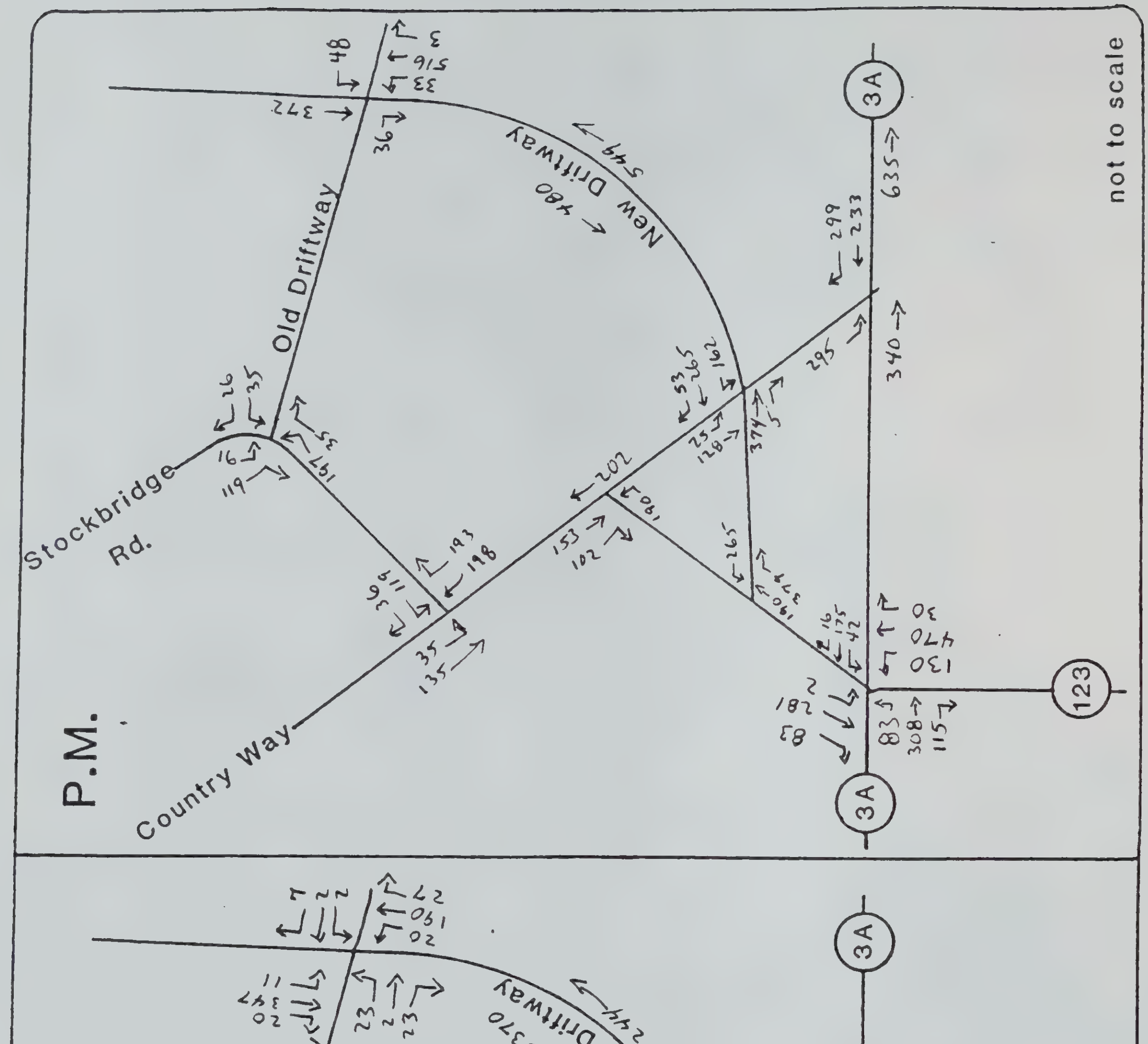

Fig. 28-2A

Year 2000 Base (2%/Year)

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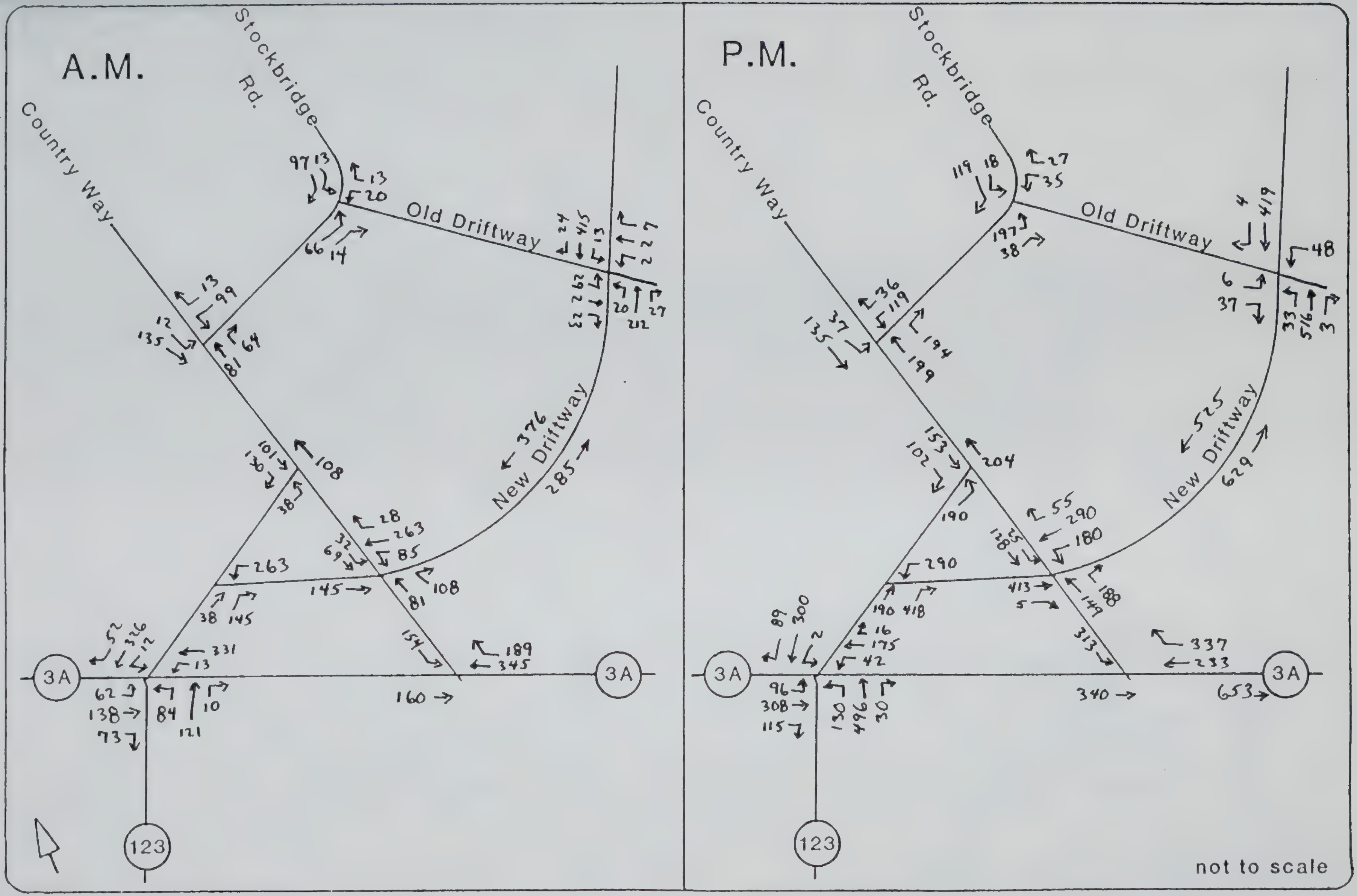

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Fig 28-2B
Year 2000 Base (2%/Year)
w/Added Develop.

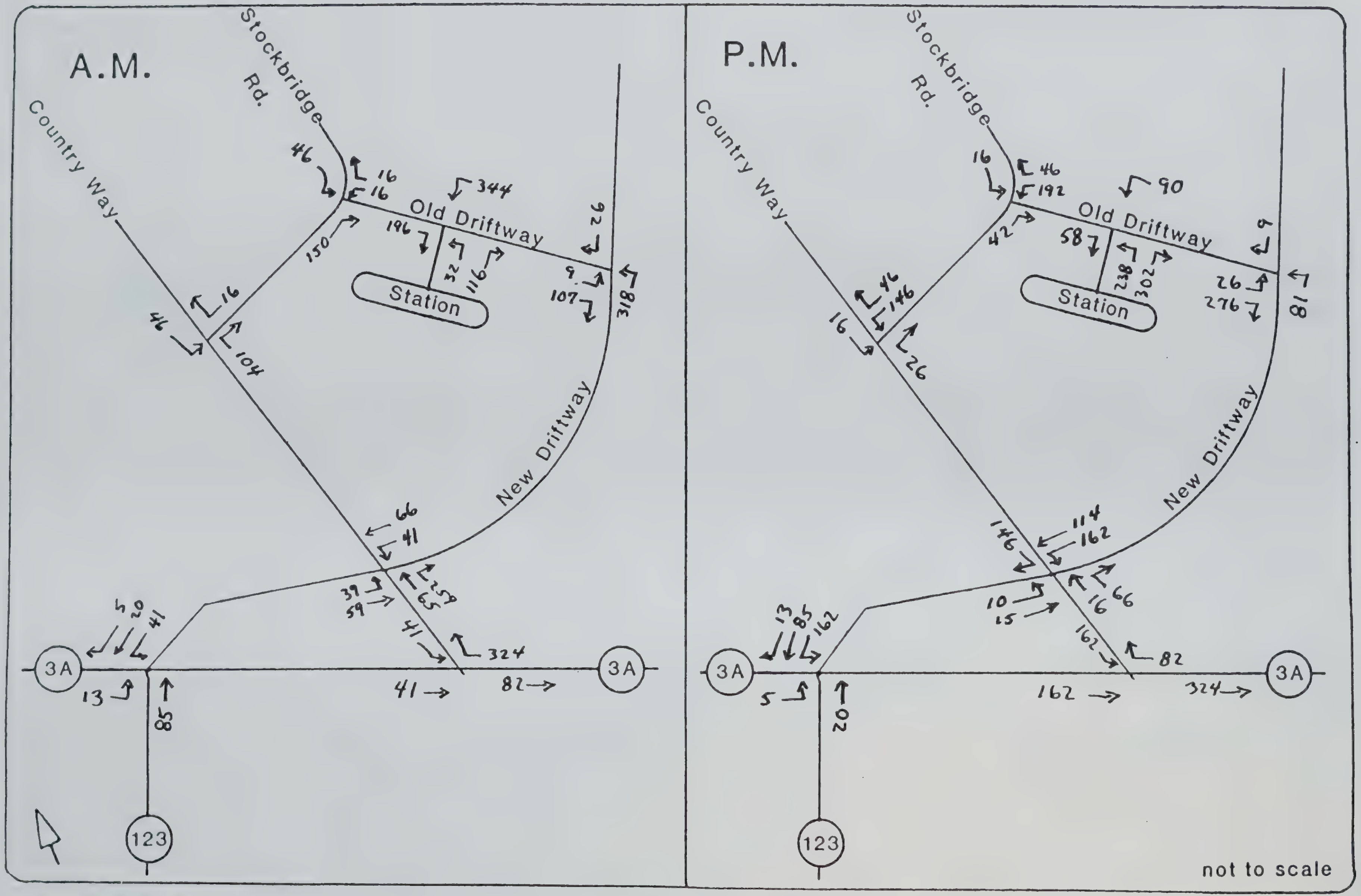

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Fig. 28-3
Greenbush Line: Driftway Station Volumes

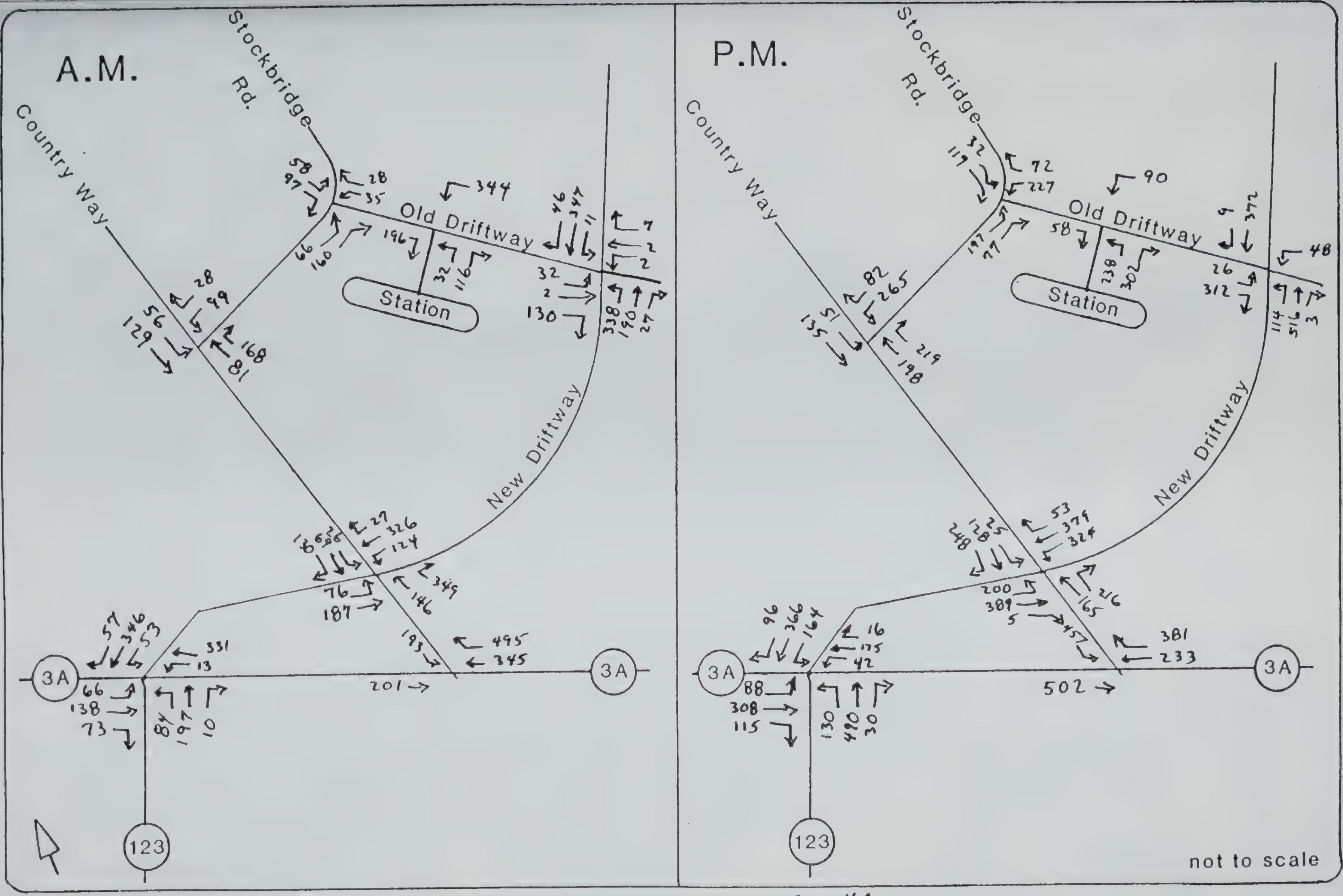

Fig. 28 - 4A
Year 2000 (2%/Year) w/station traffic

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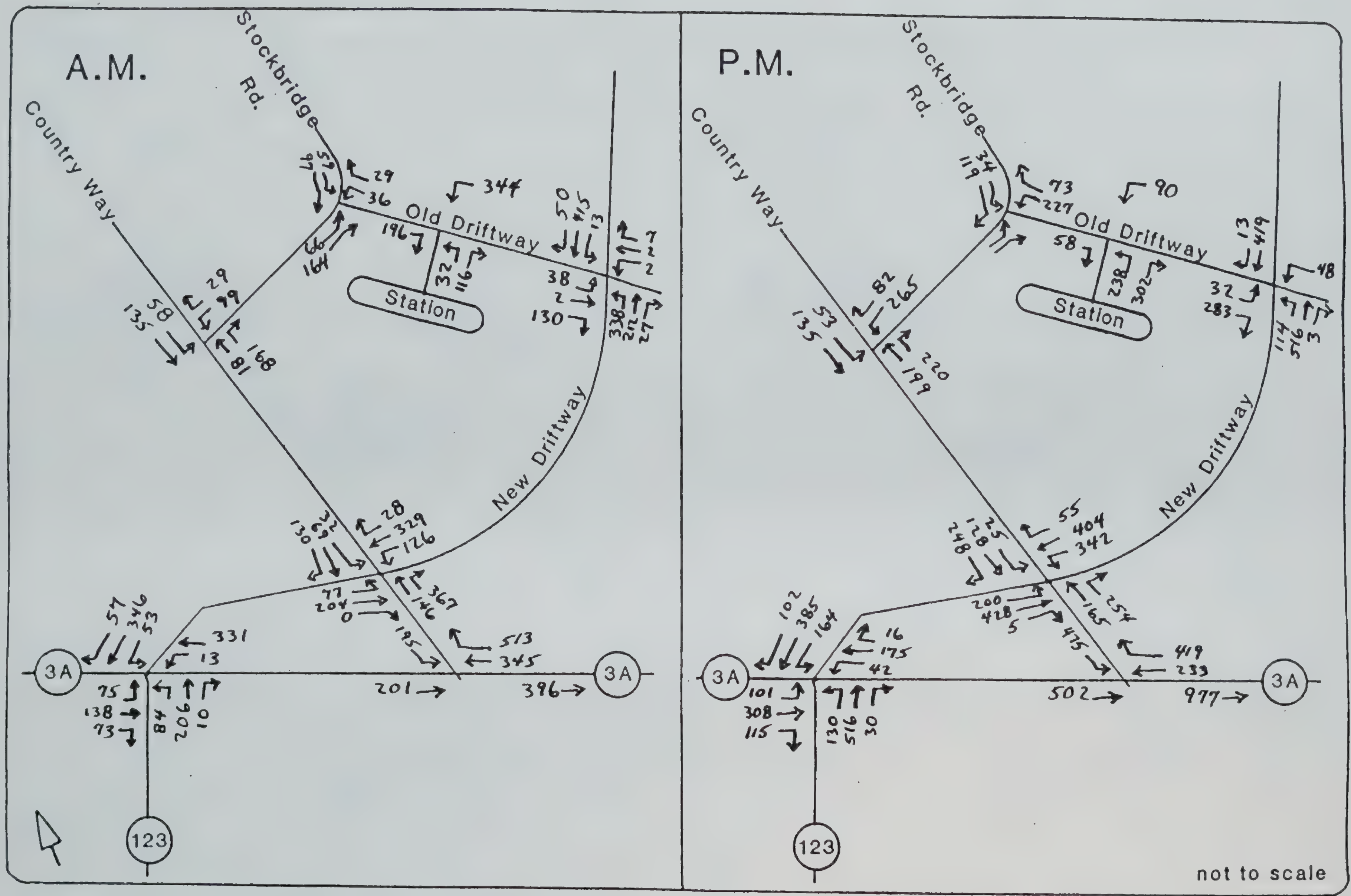

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Fig. 28-4B
Future Traffic w/station + Added Develop.
– Redesign 1 (2-Way)

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Figure I–1
Old Colony Area Communities

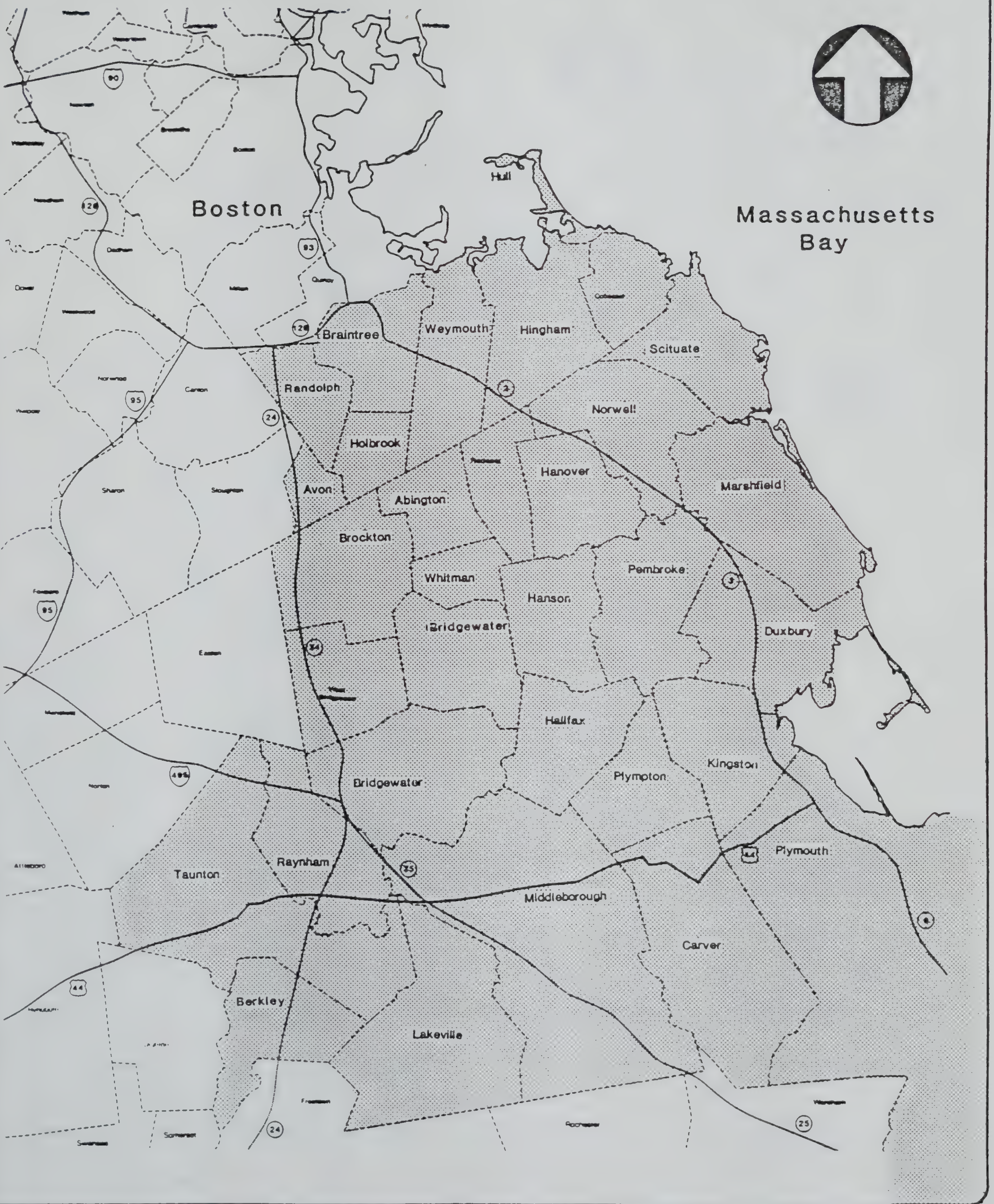

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Figure II-14
Proposed Old Colony Railroad Lines

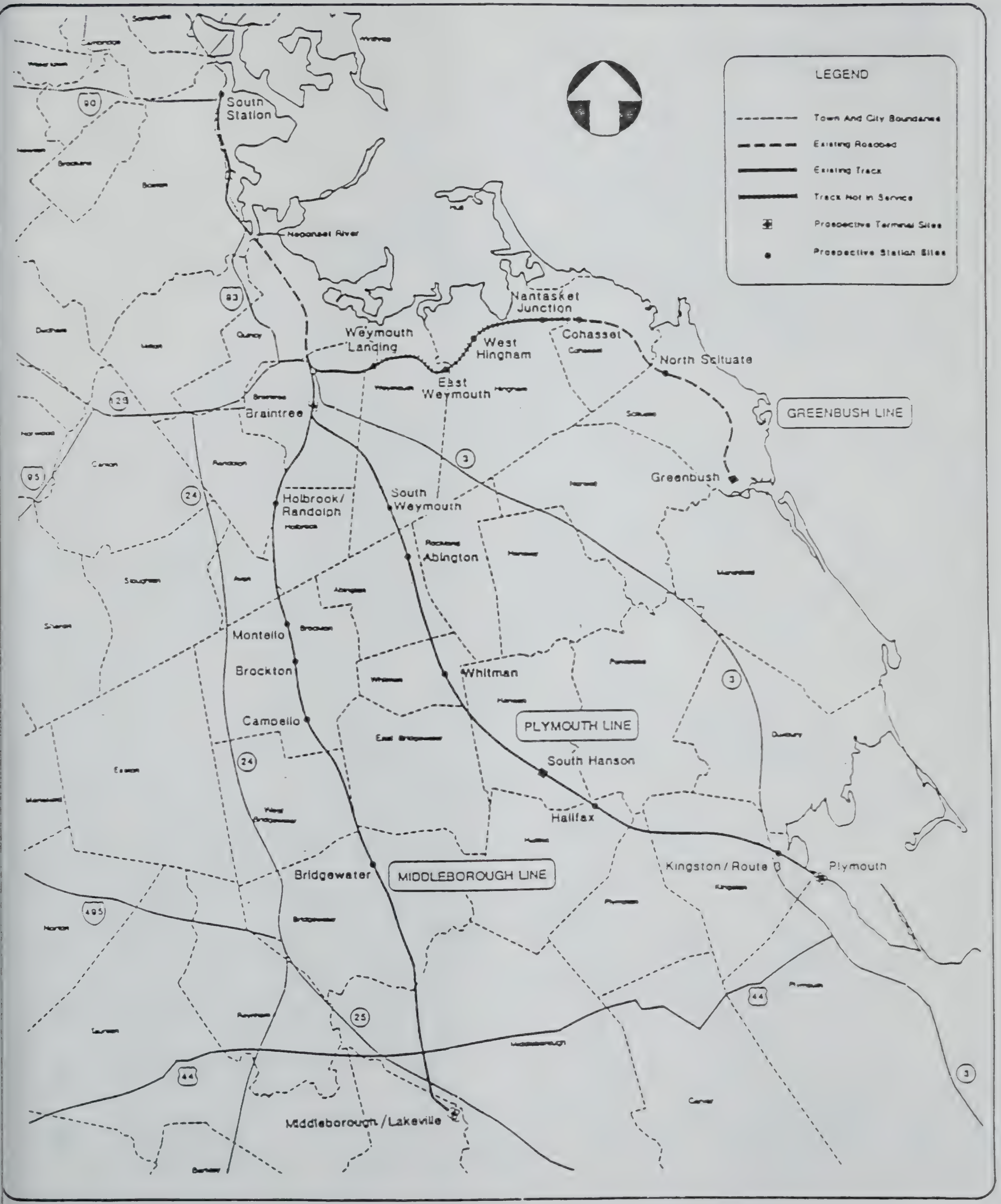

Figure II–18
Braintree Station Site

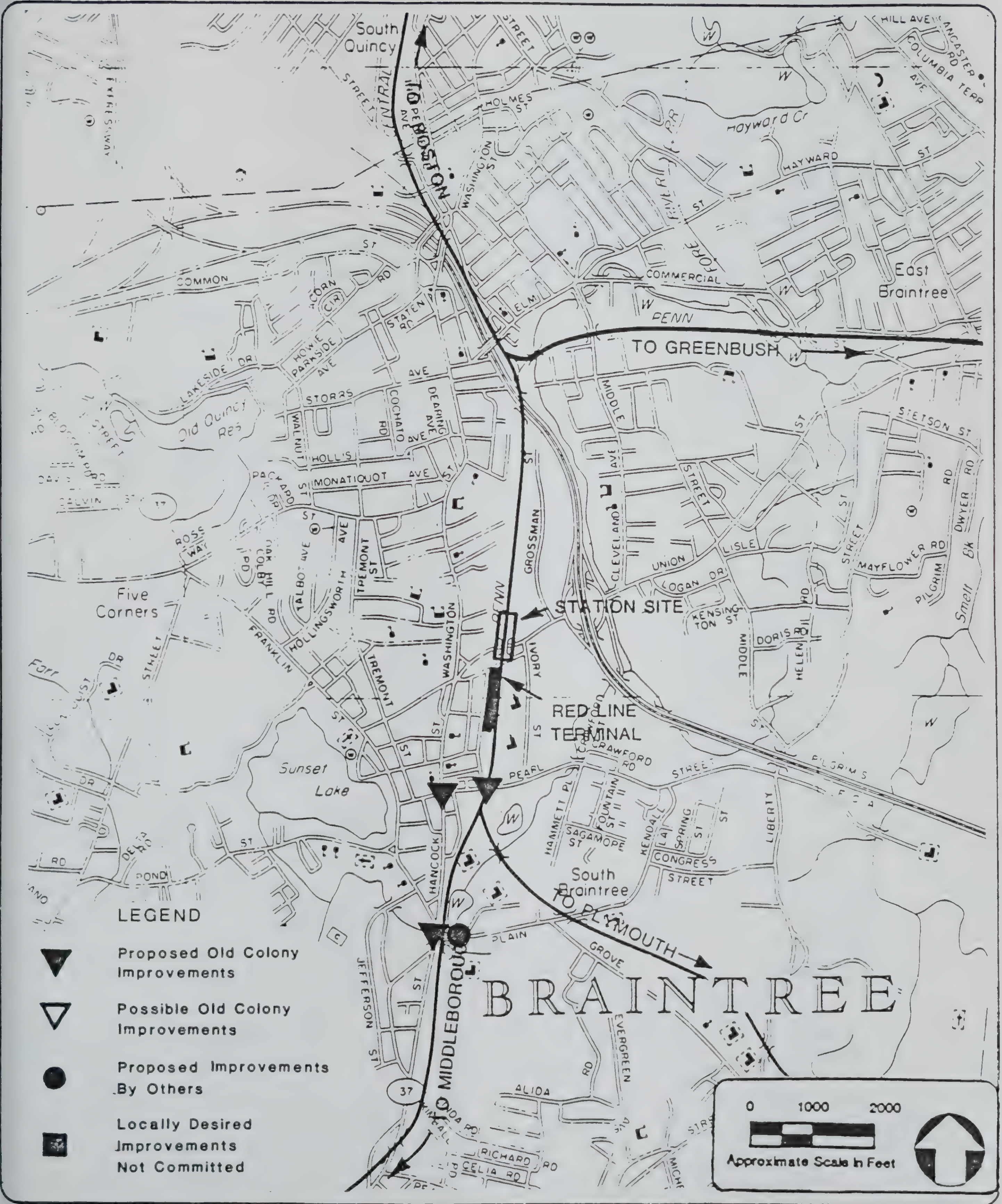

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Figure II-23
Holbrook/Randolph Station Site

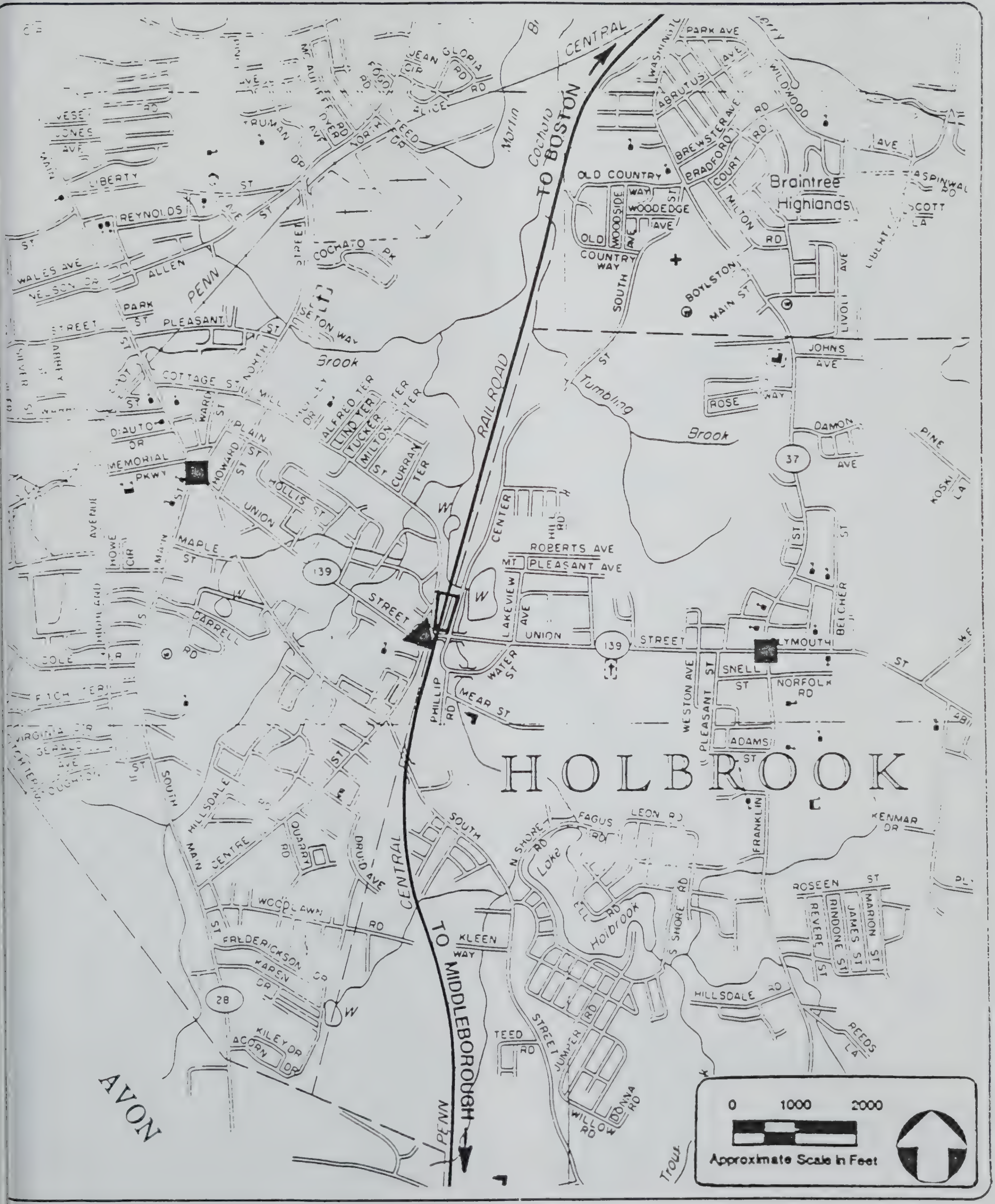

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Figure II-24
Montello Station Site

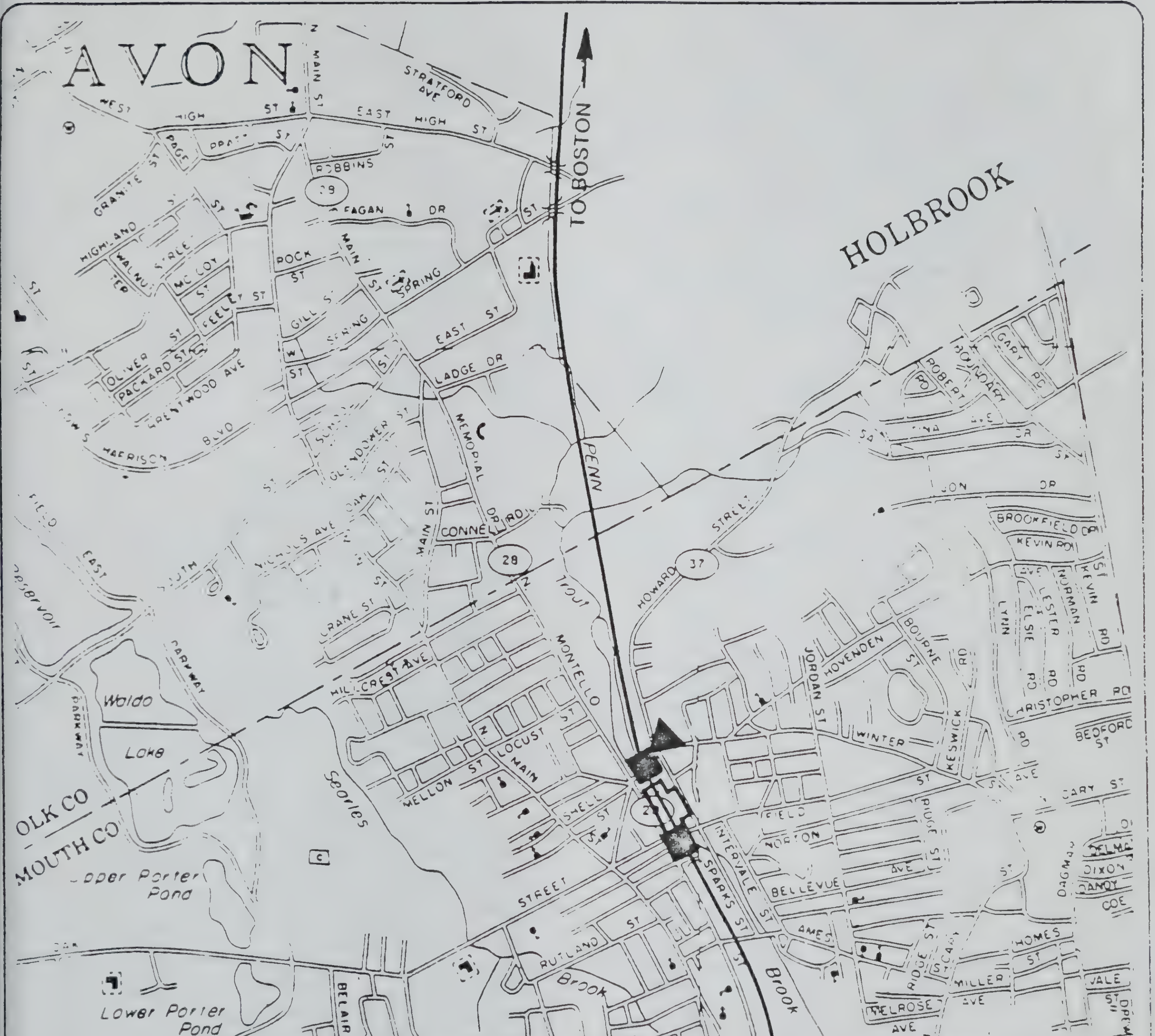

Figure II-25
Brockton Station Site

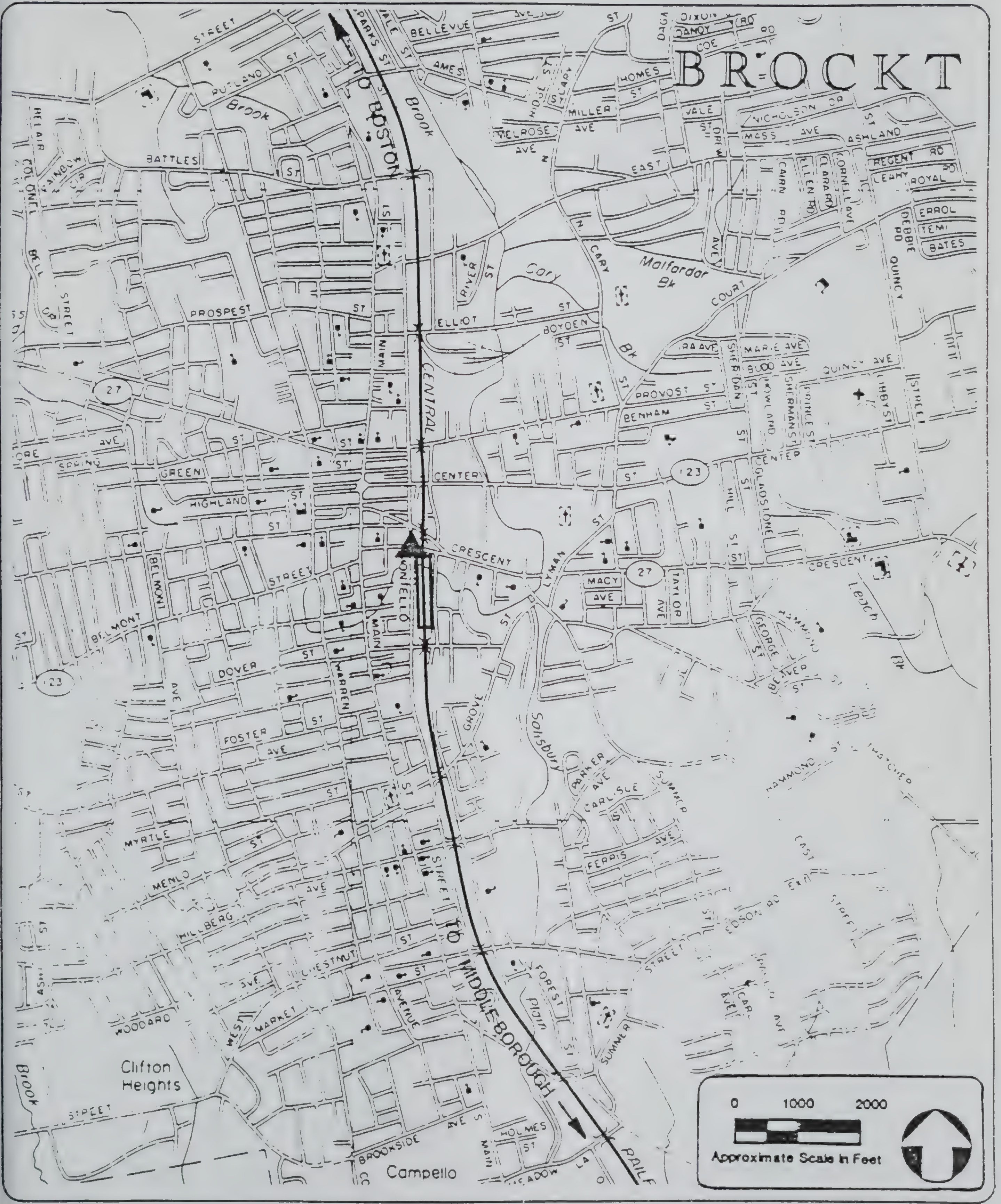

Figure II-26
Campello Station Site

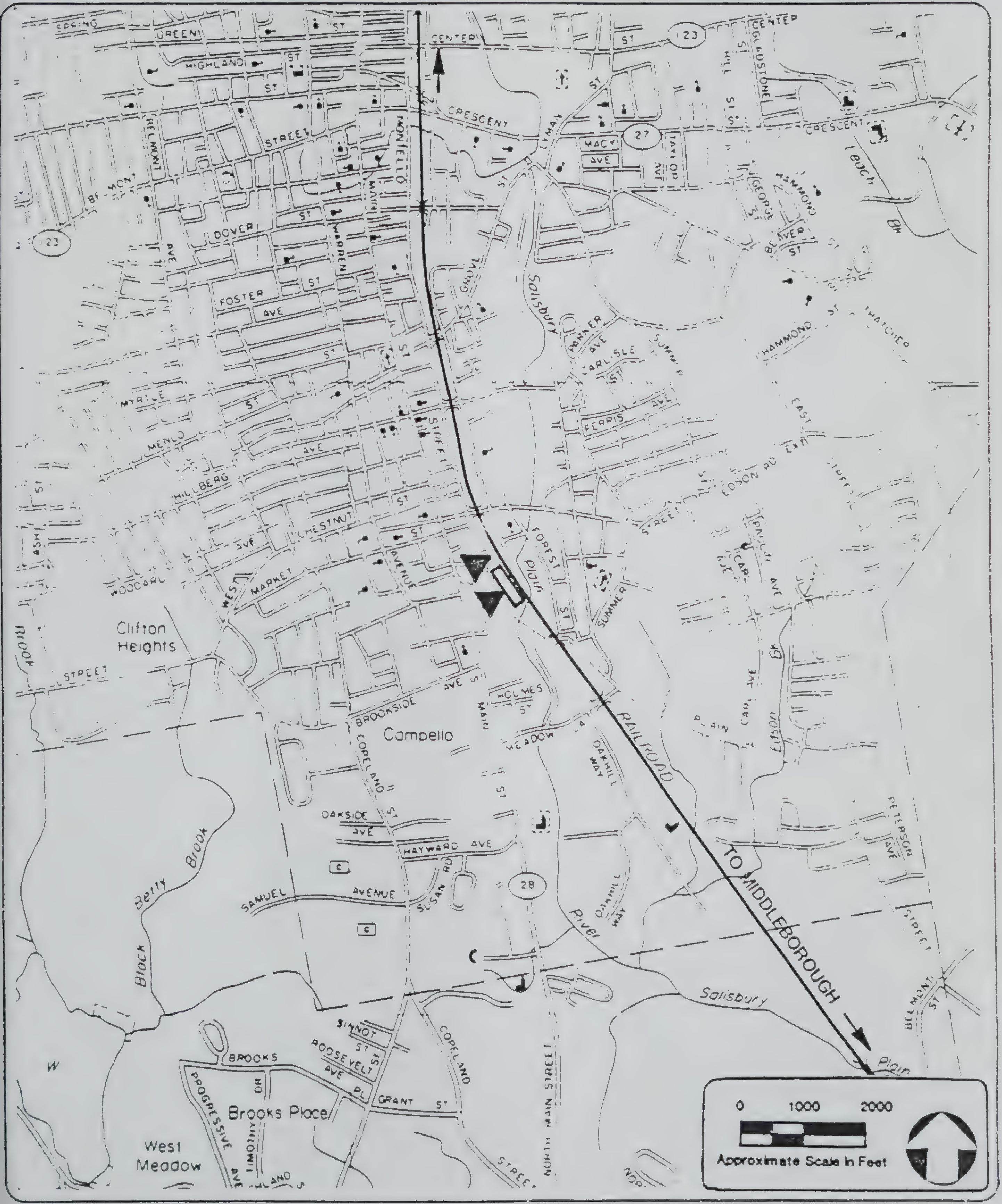

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Figure II-27

Bridgewater/Bridgewater State College Station Site

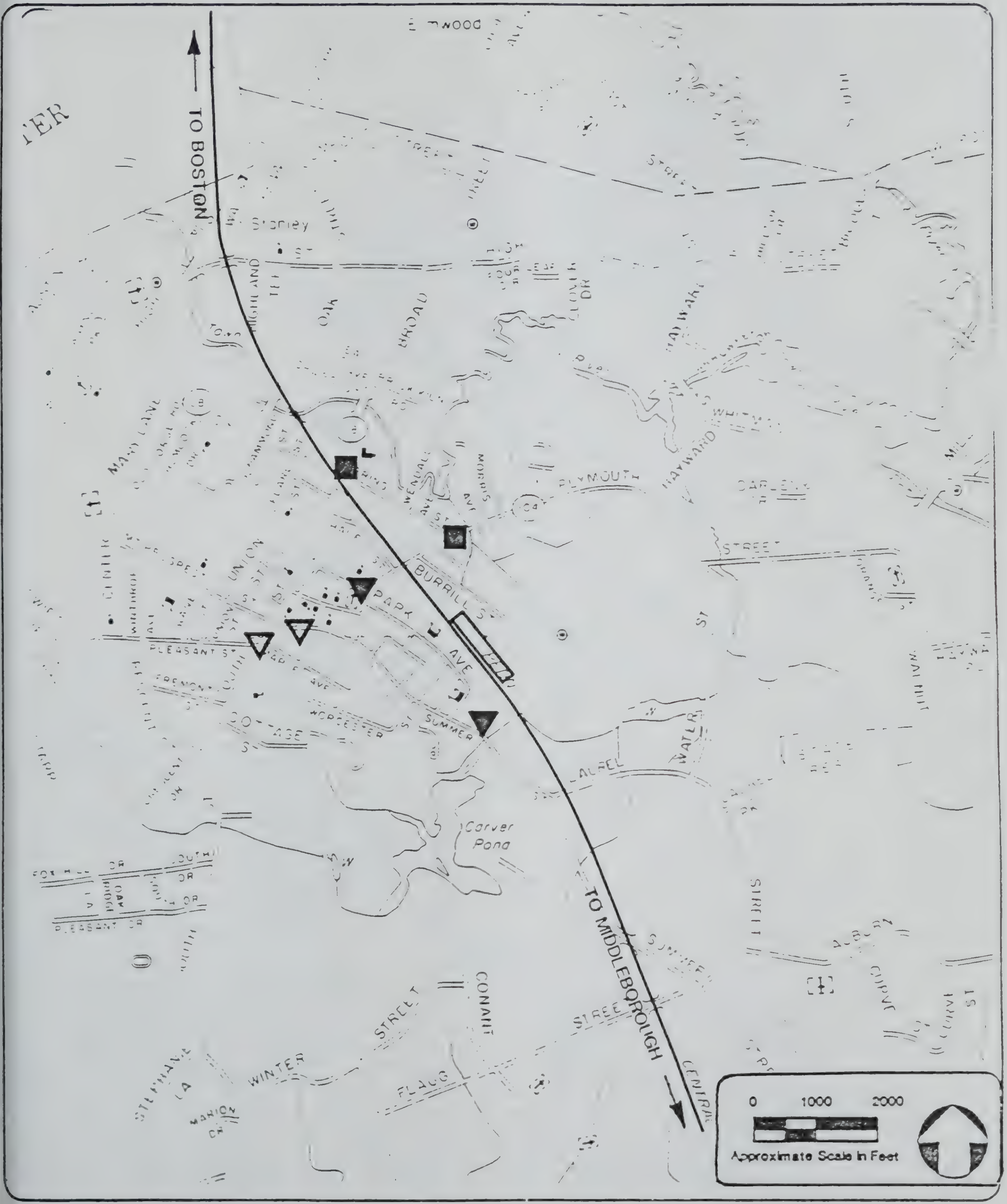

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Figure II-28
Middleborough/Lakeville/
I-495 Station Site

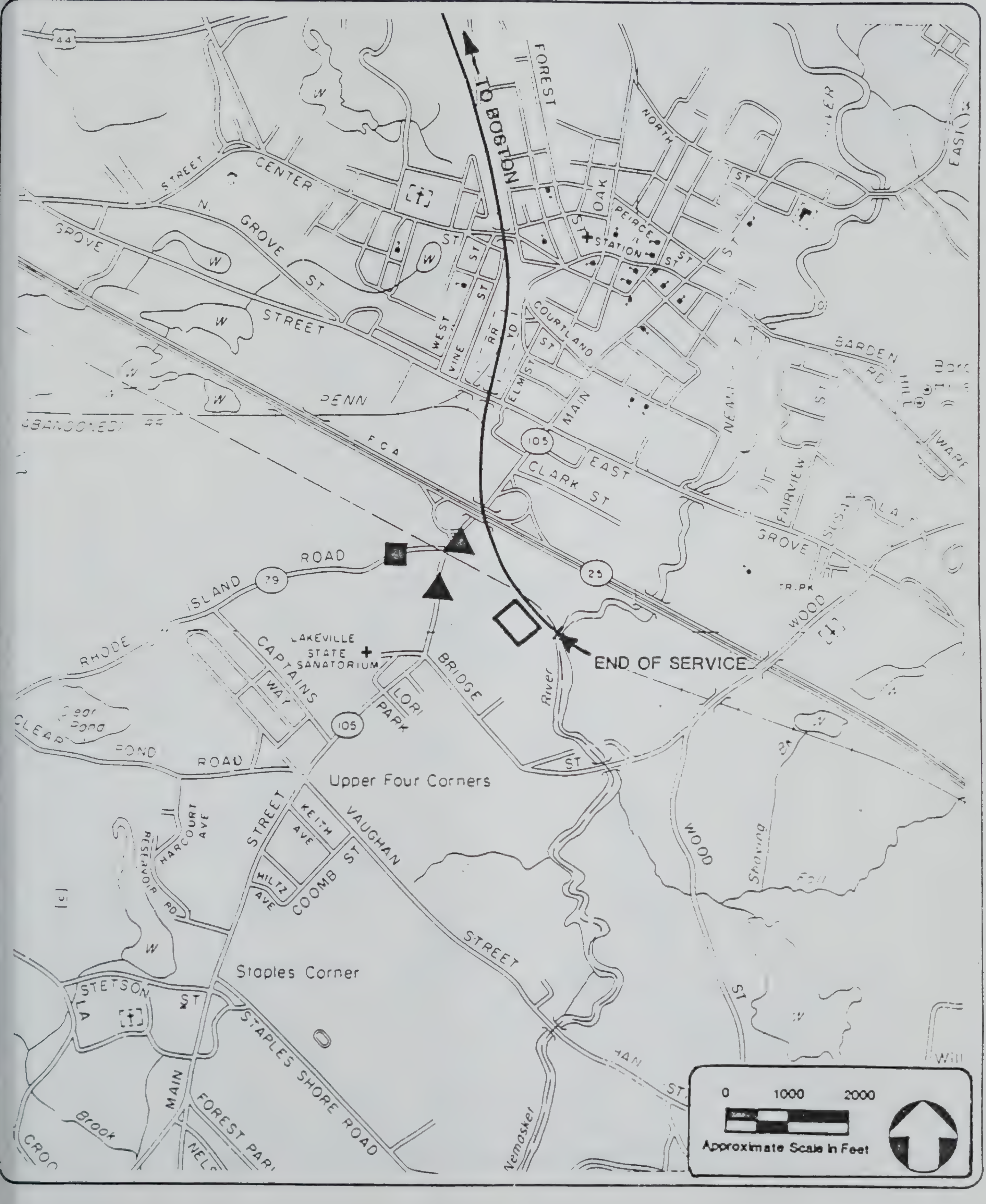

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Figure II-35
South Weymouth Station Site

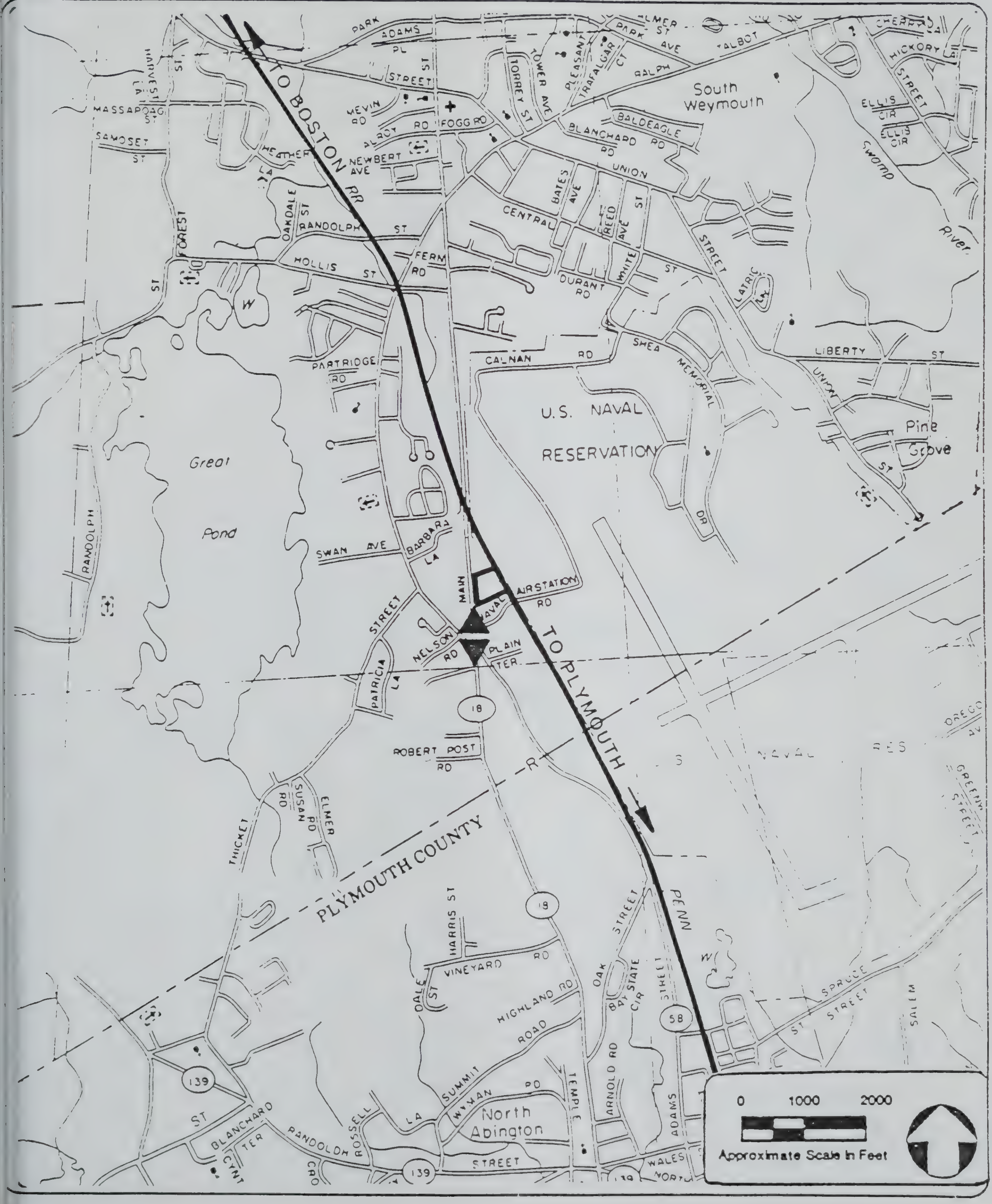

Figure II-36 Abington Station Site

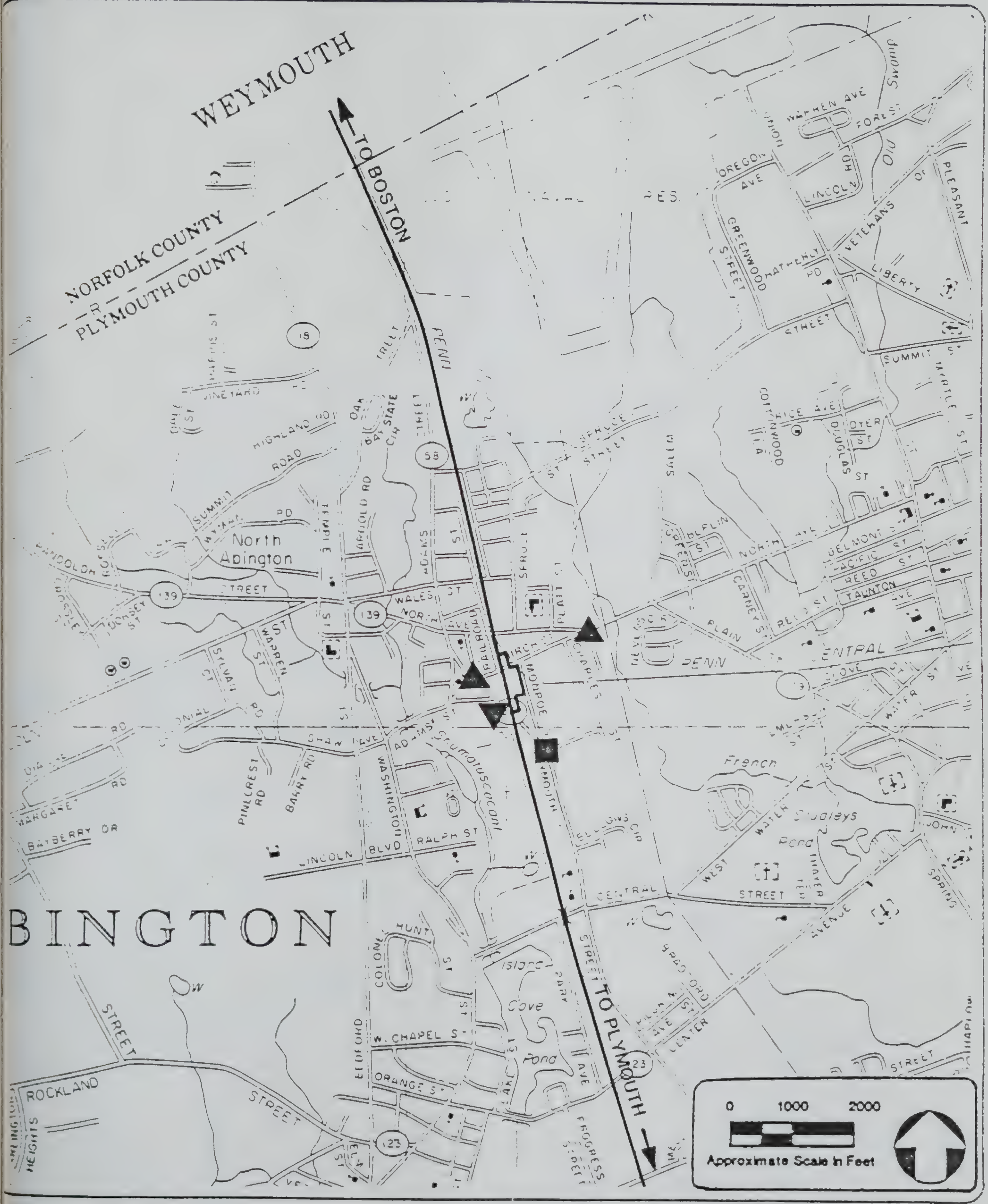

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Figure II-37
Whitman Station Site

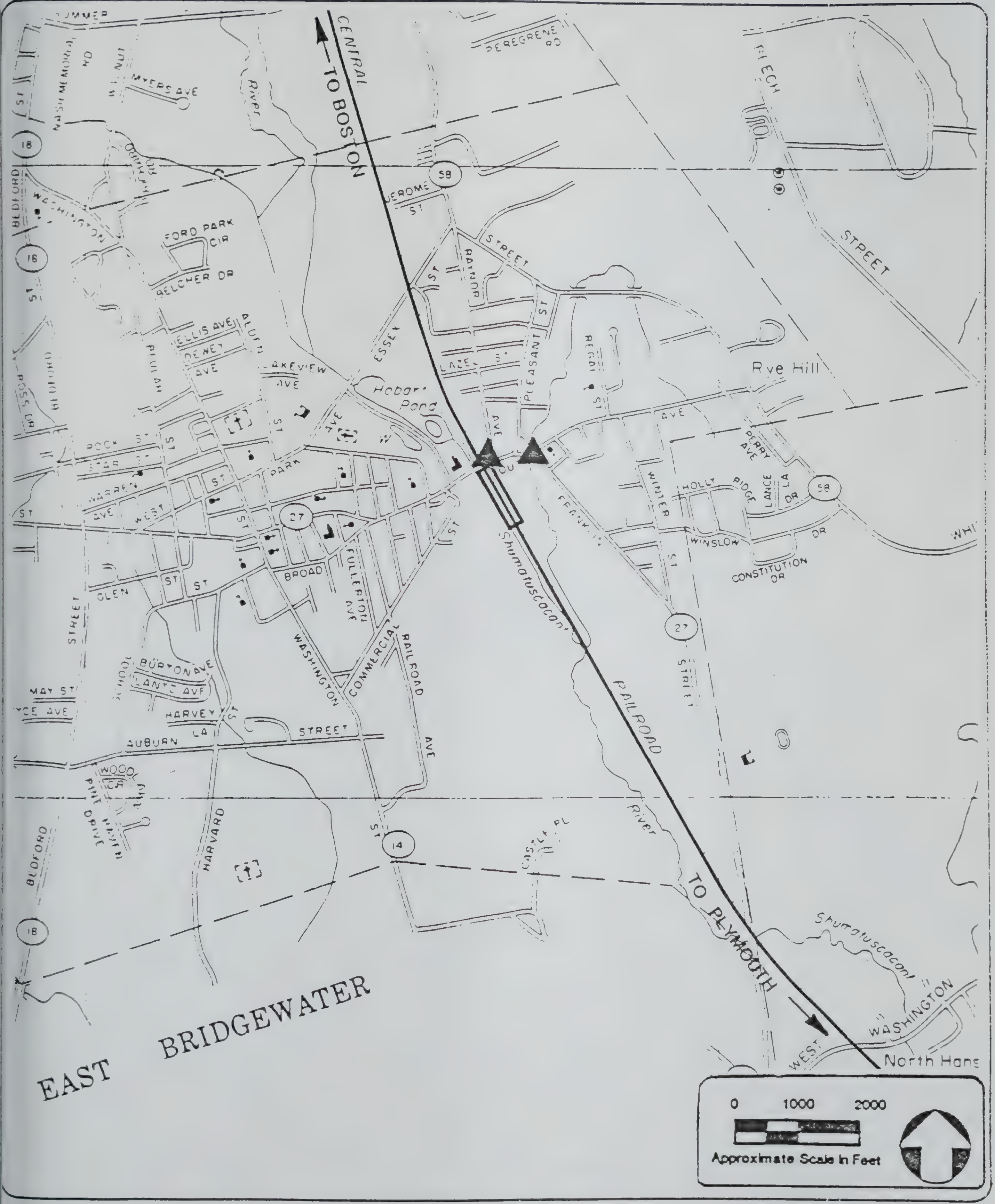
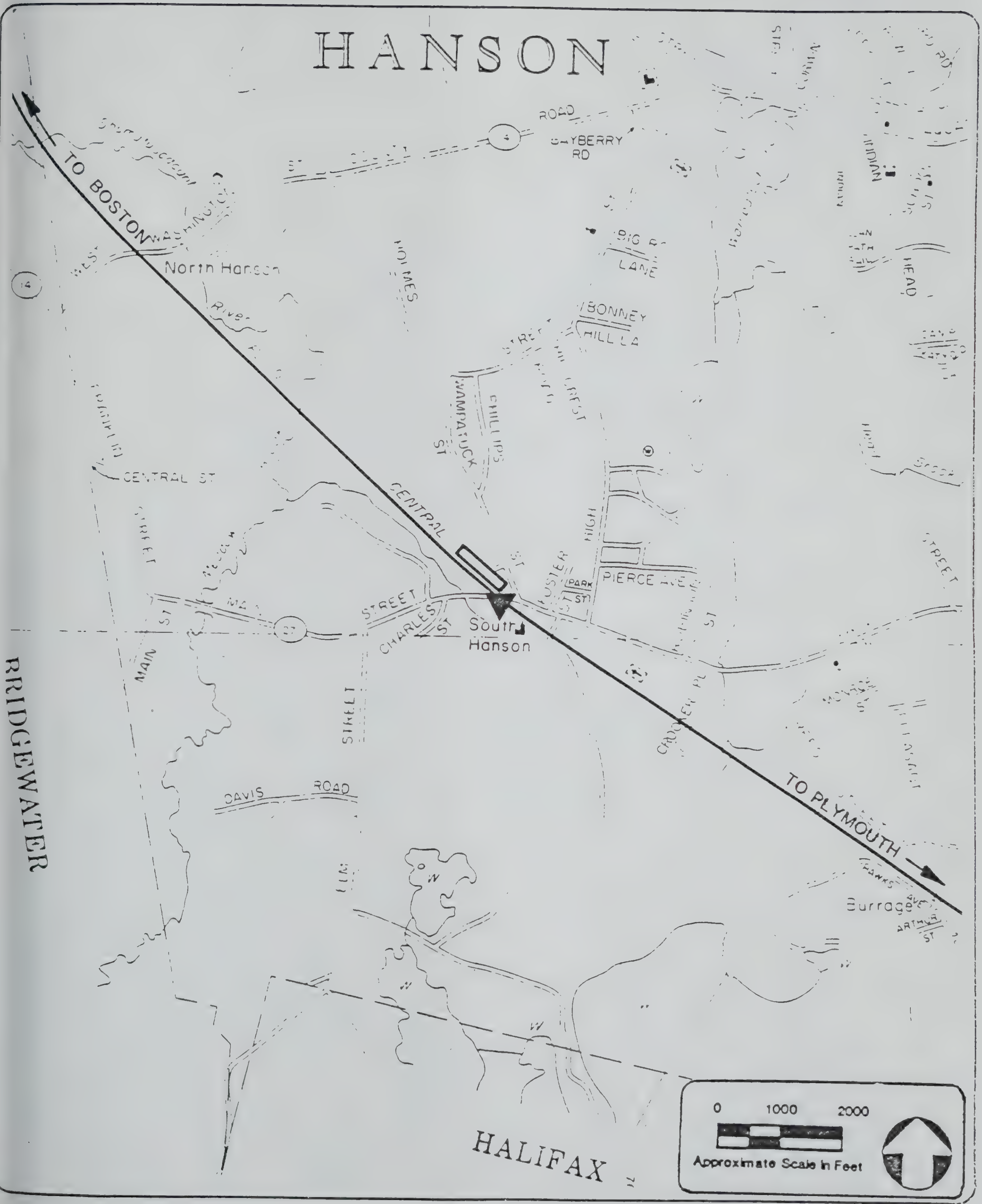


Figure II-38
Hanson Station Site



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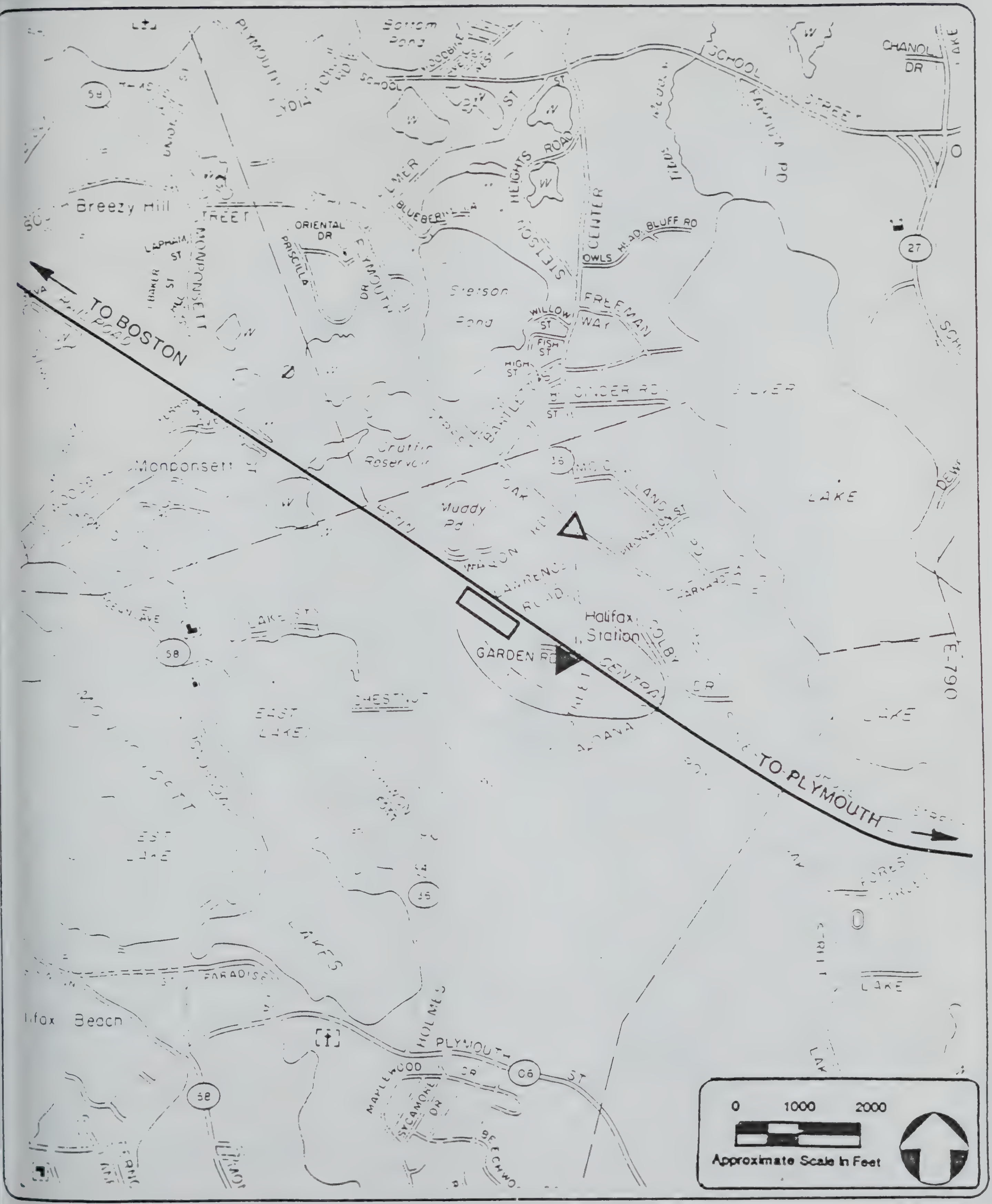

Figure II-39
Halifax Station Site

Figure II-40
Route 3 Station Site

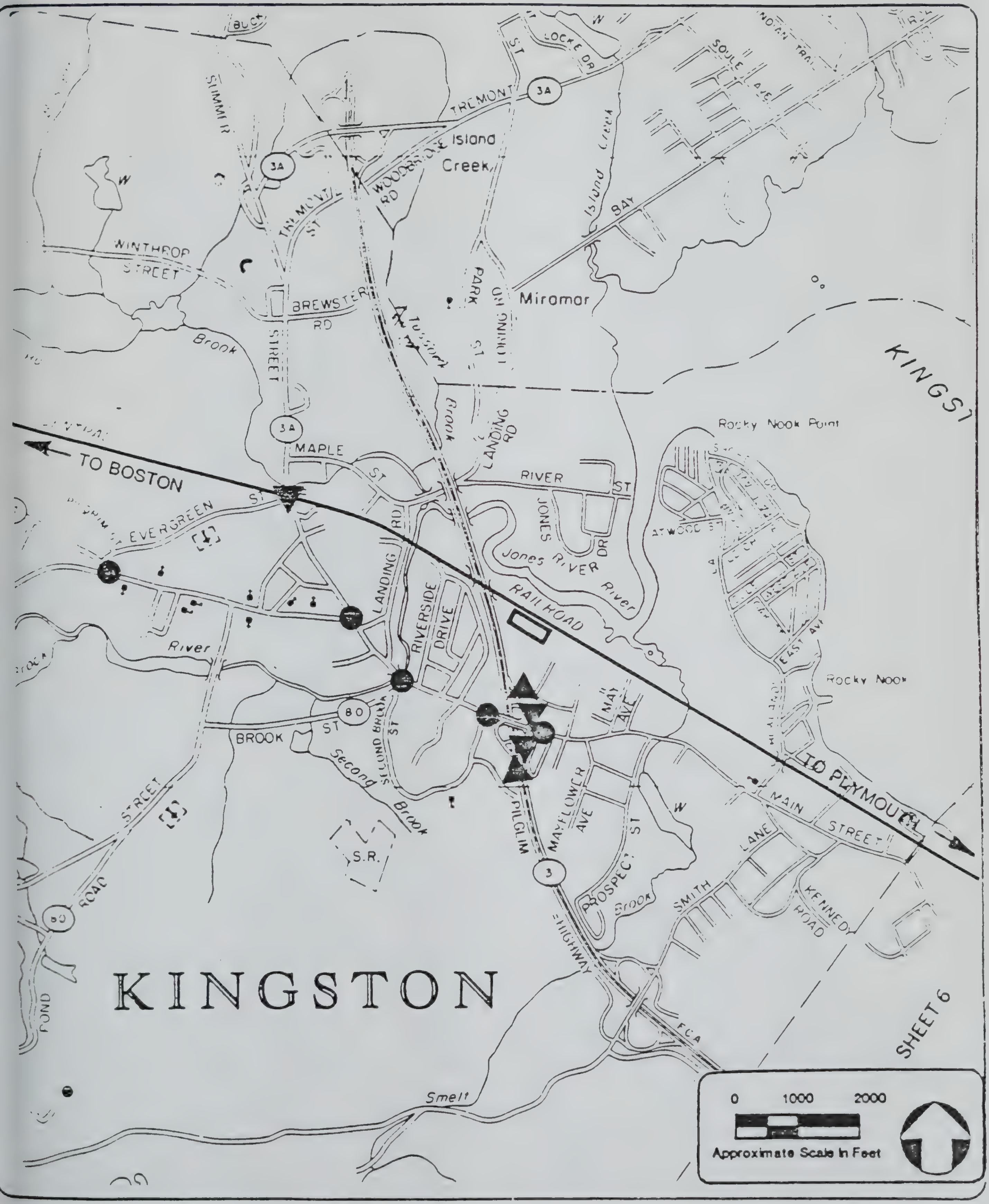

Figure II-41
Plymouth Station Site

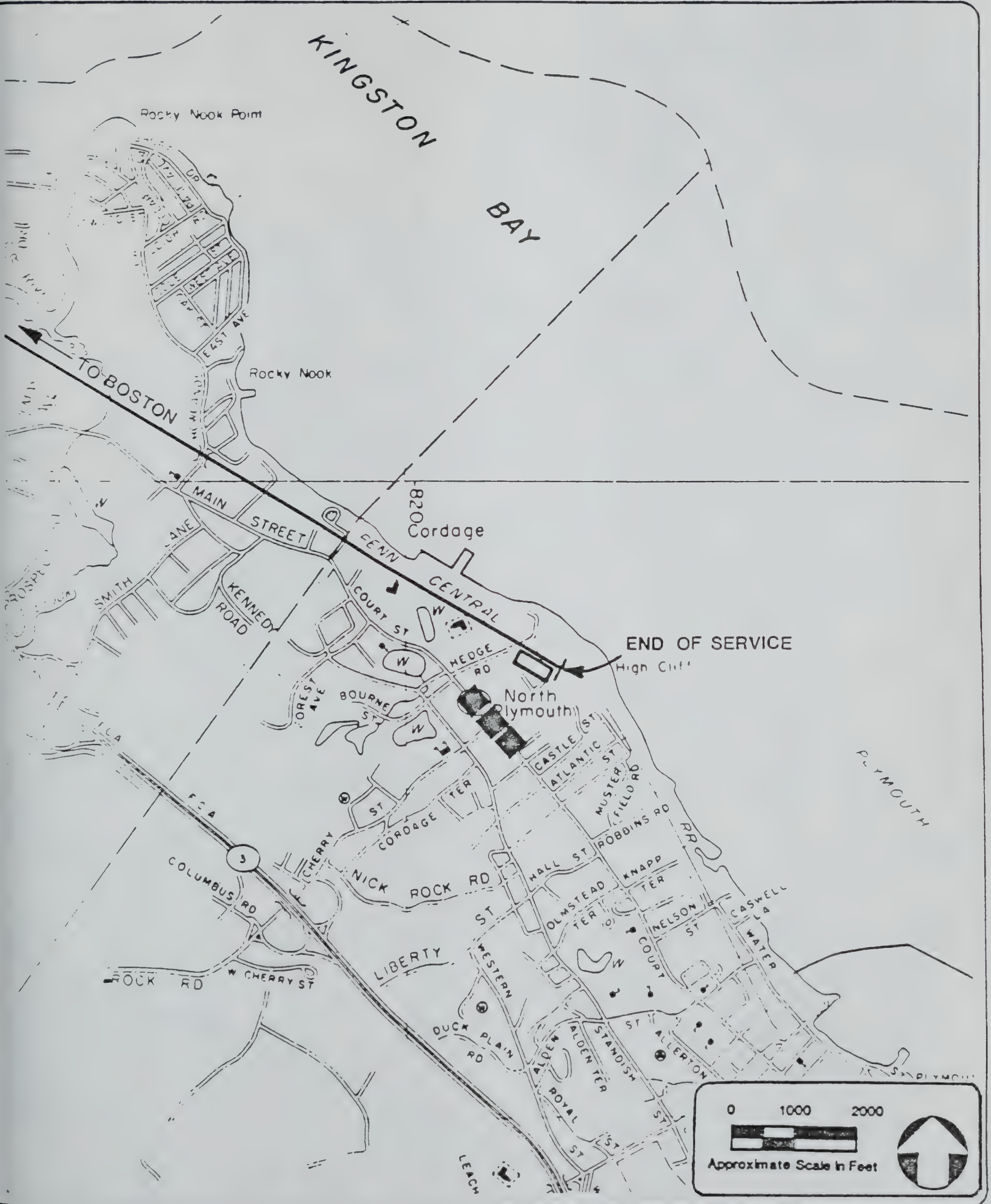

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Figure II-47
Weymouth Landing
Station Site

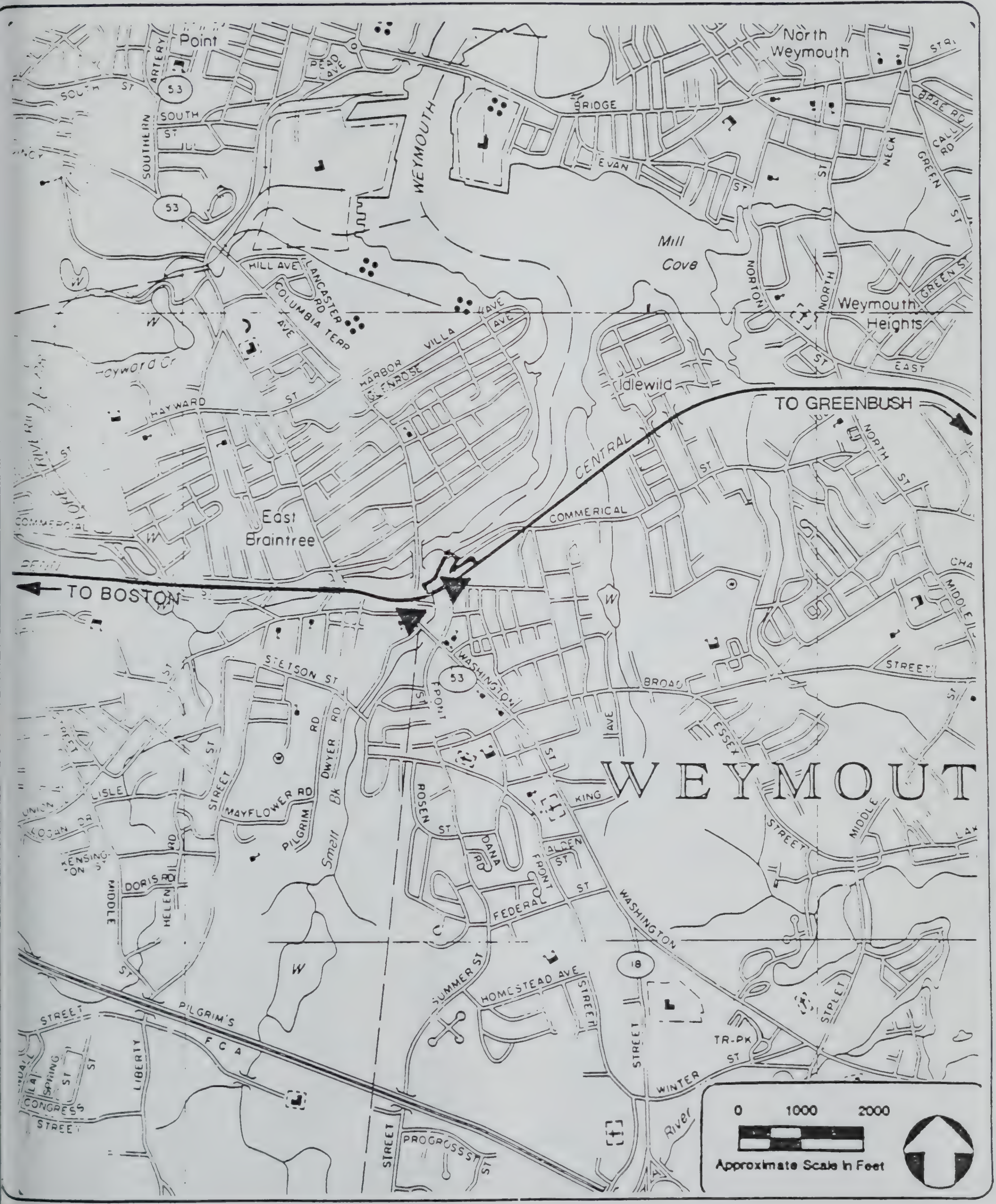

Figure II-48

East Weymouth Station Site

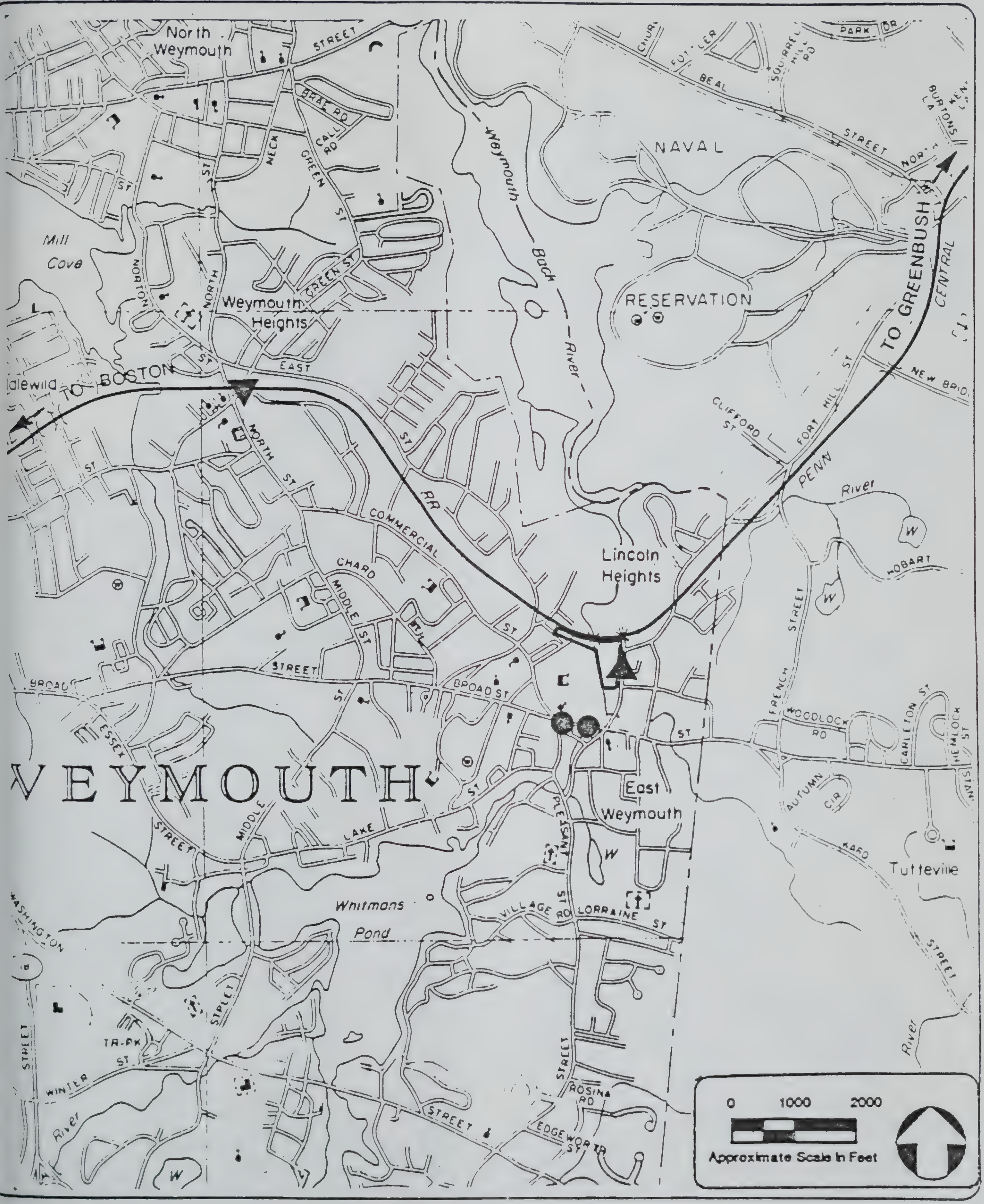

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Figure II-49

West Hingham Station Site

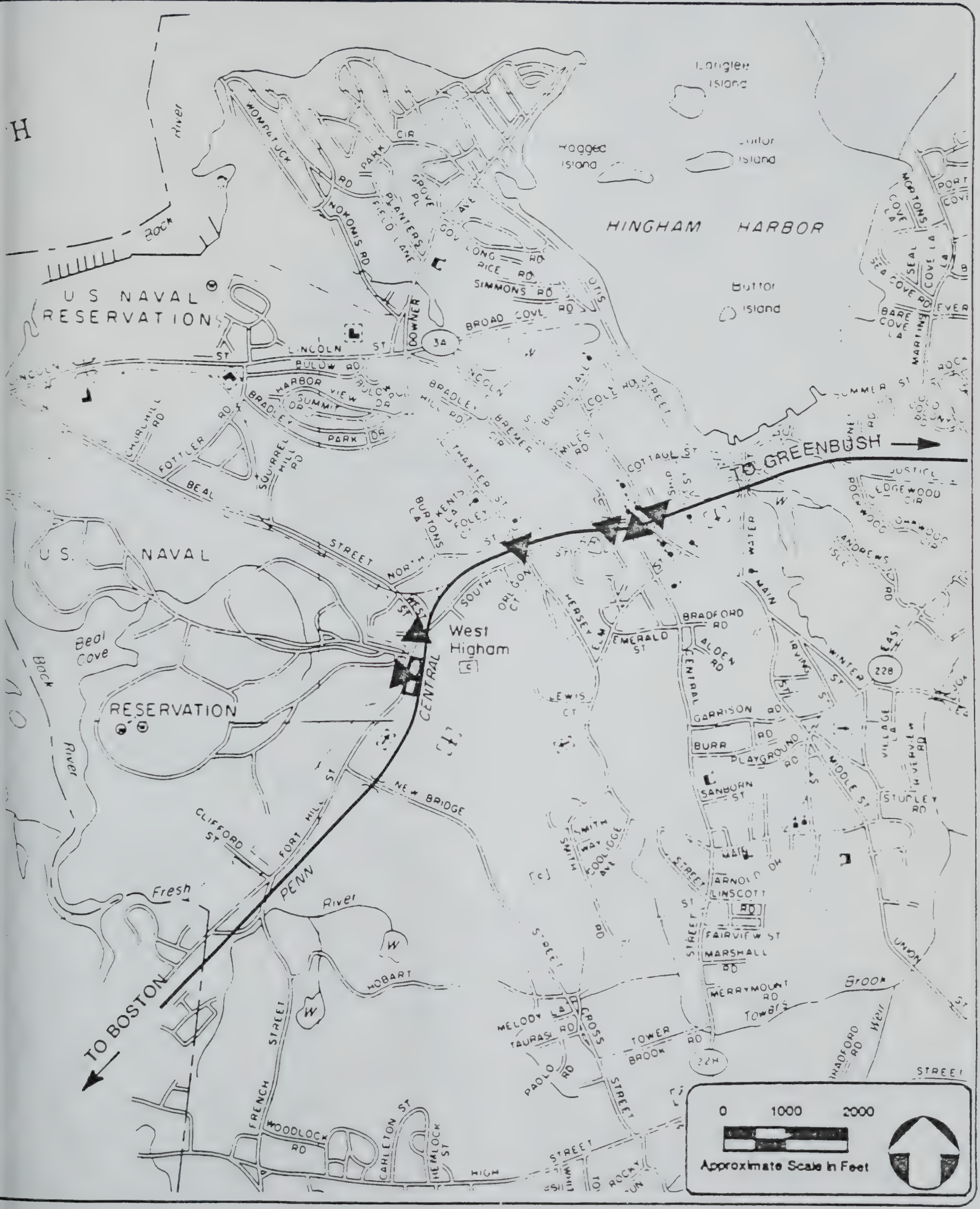

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Figure II-50
Nantasket Junction
Station Site

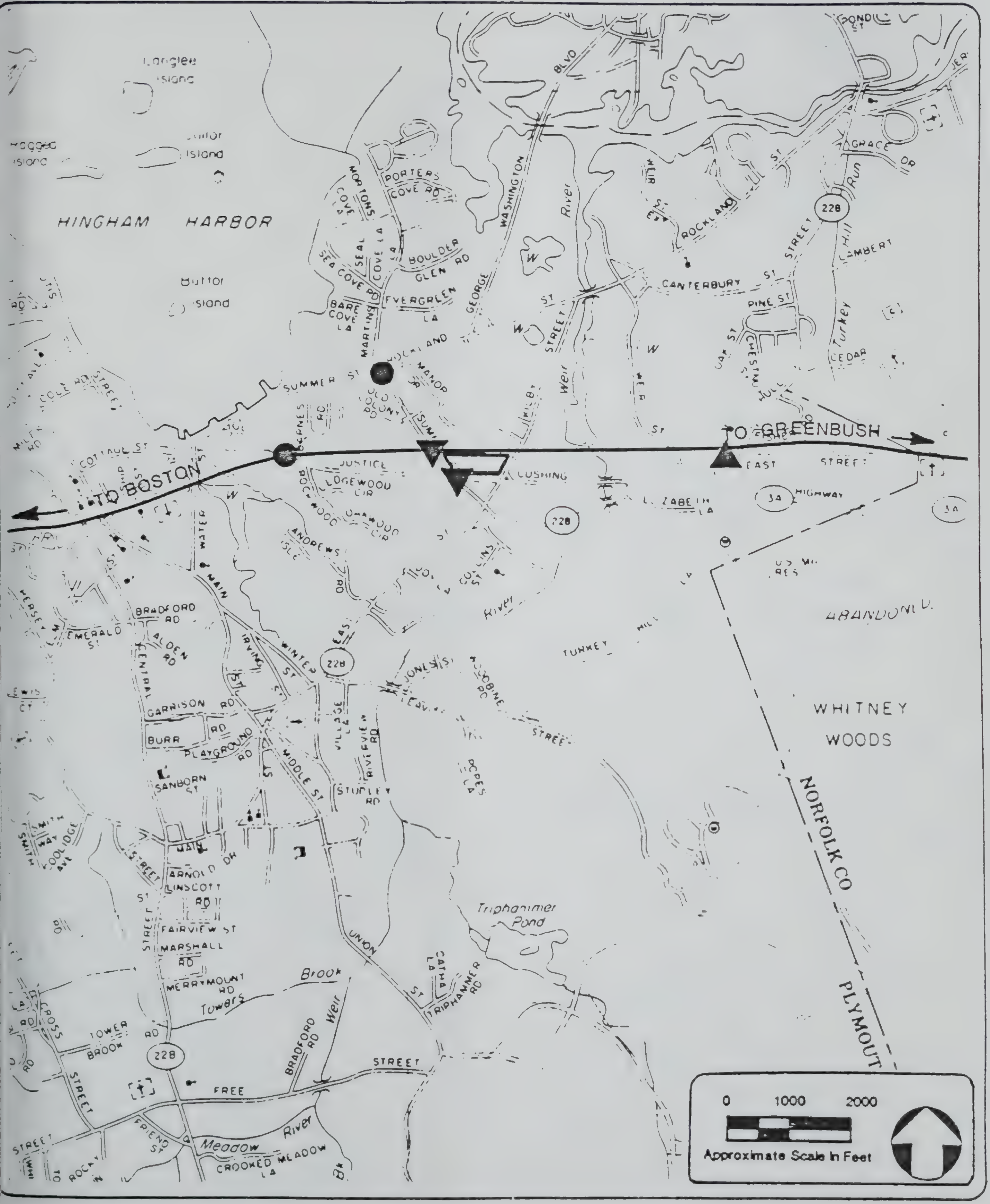

Figure II-51
Cohasset Station Site

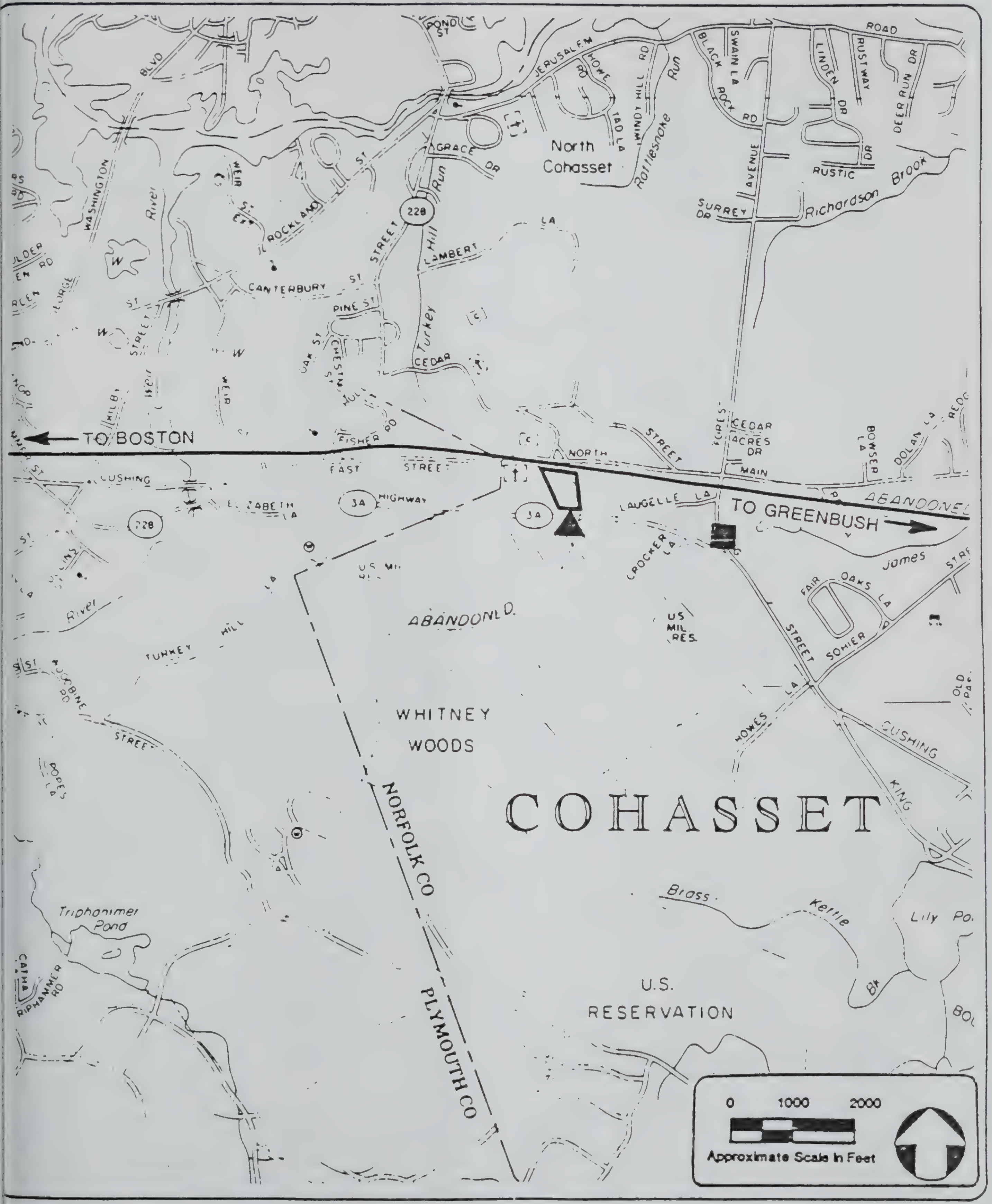

Figure II-52

North Scituate Station Site

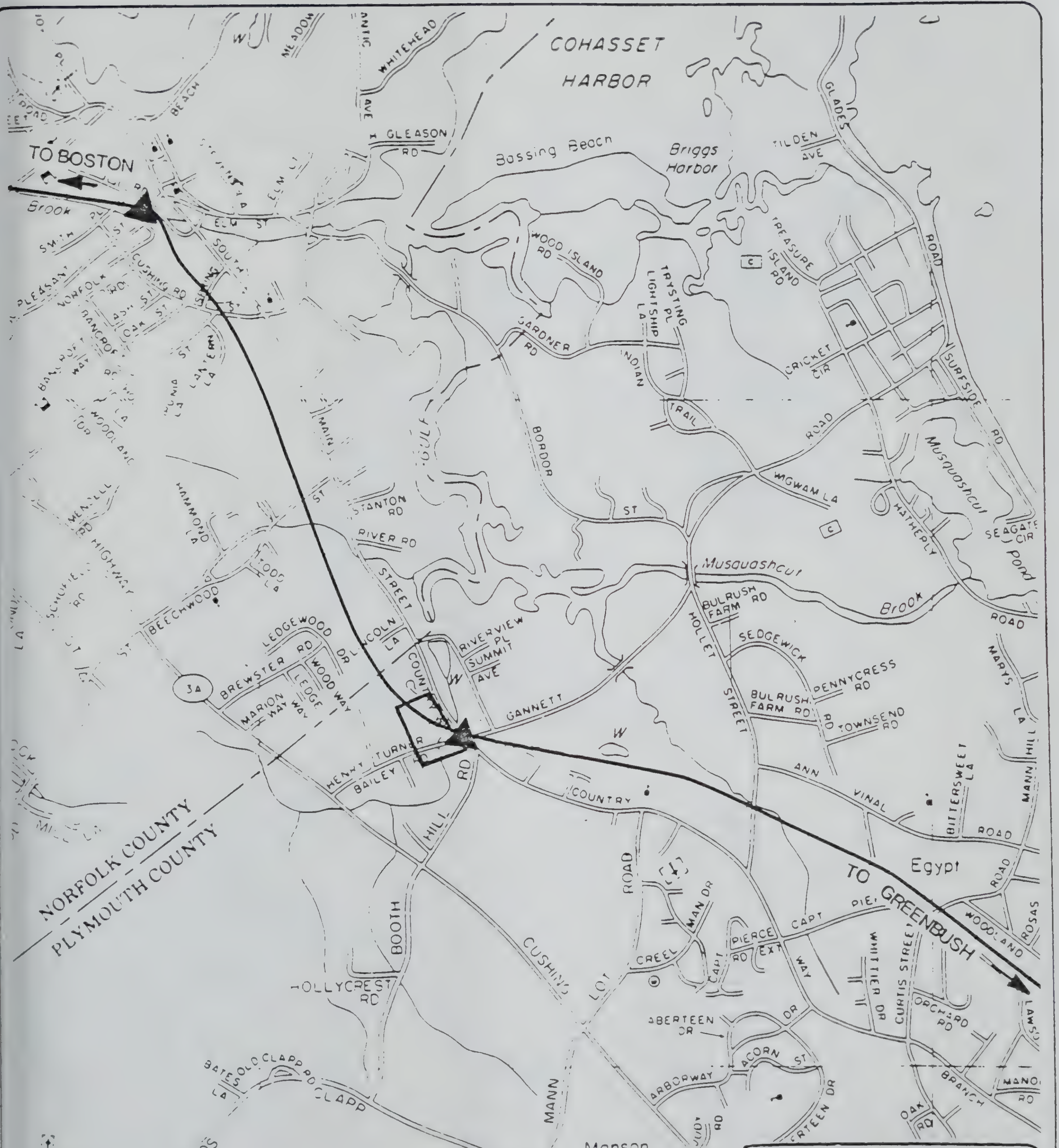

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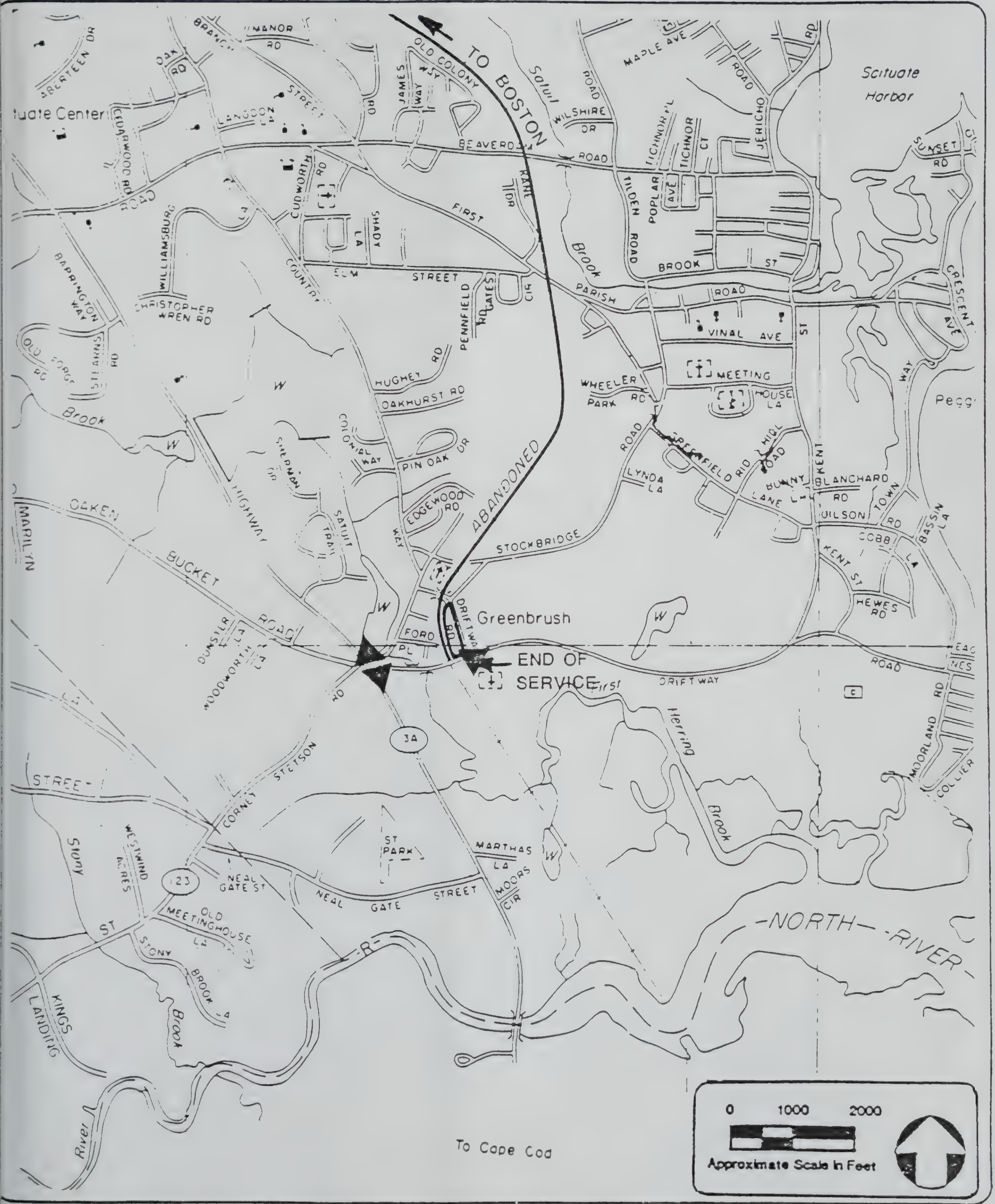
Figure II-53
Greenbush Station Site



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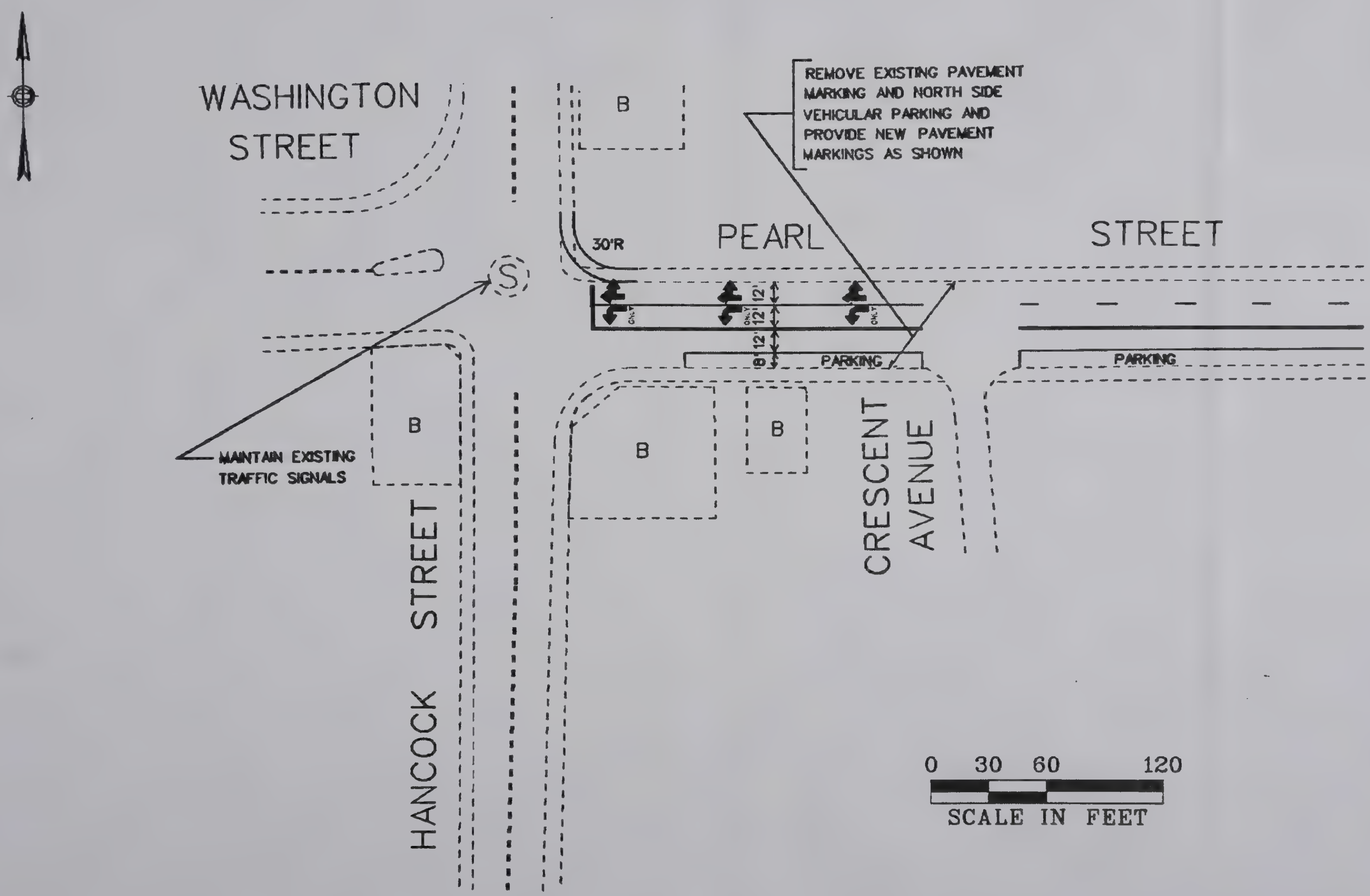
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

BRAINTREE:
PEARL, HANCOCK AND WASHINGTON STREETS

Figure VIII-C1



WASHINGTON STREET
PEARL STREET
HANCOCK STREET
CRESCENT AVENUE
B
B
B
B
S
30'R
12'
12'
12'
8'
ONLY
PARKING
PARKING
REMOVE EXISTING PAVEMENT MARKING AND NORTH SIDE VEHICULAR PARKING AND PROVIDE NEW PAVEMENT MARKINGS AS SHOWN
MAINTAIN EXISTING TRAFFIC SIGNALS

0
30
60
120
SCALE IN FEET

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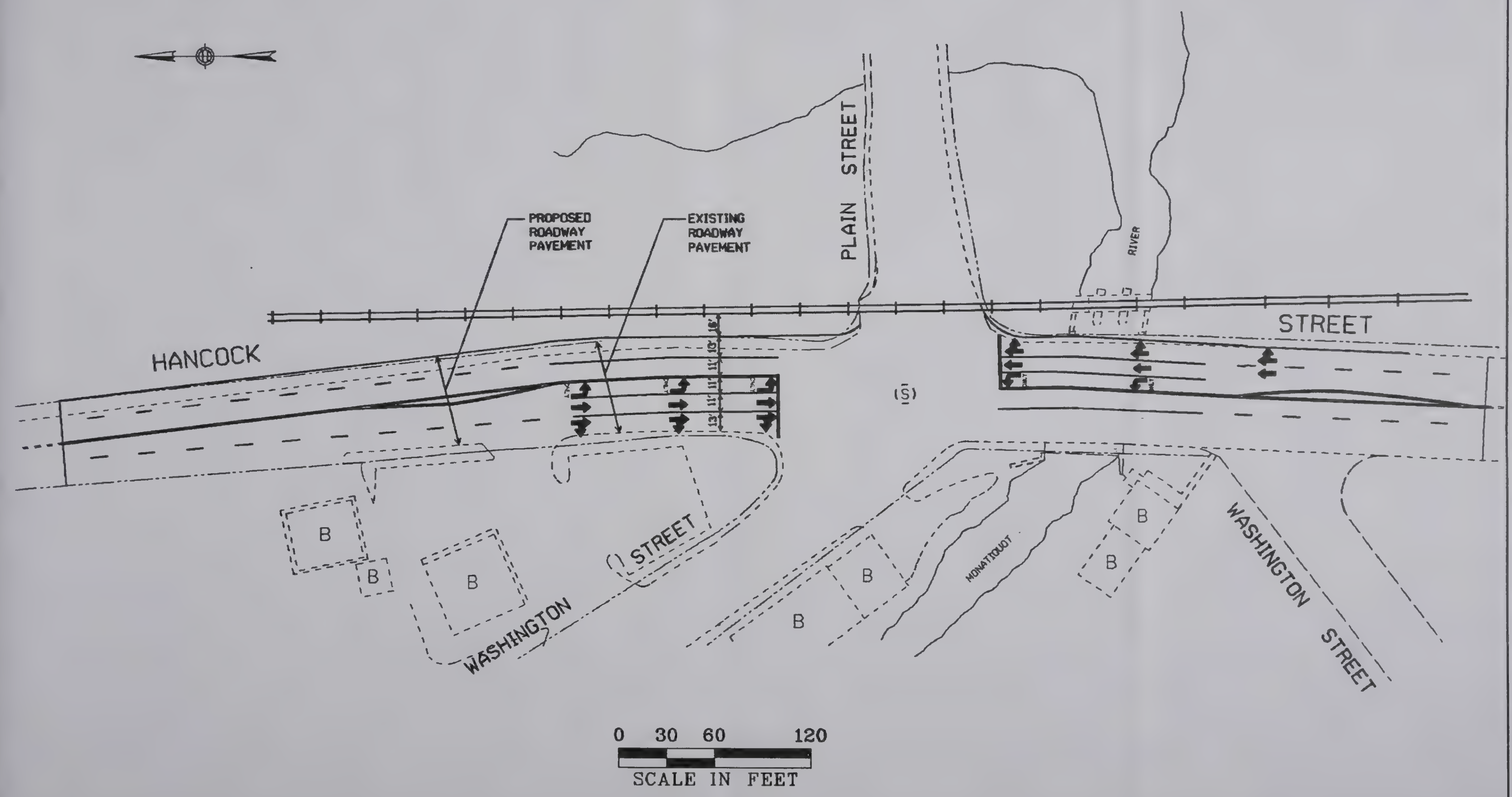
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

BRAINTREE:
HANCOCK, PLAIN AND
WASHINGTON STREETS

Figure VIII-C2



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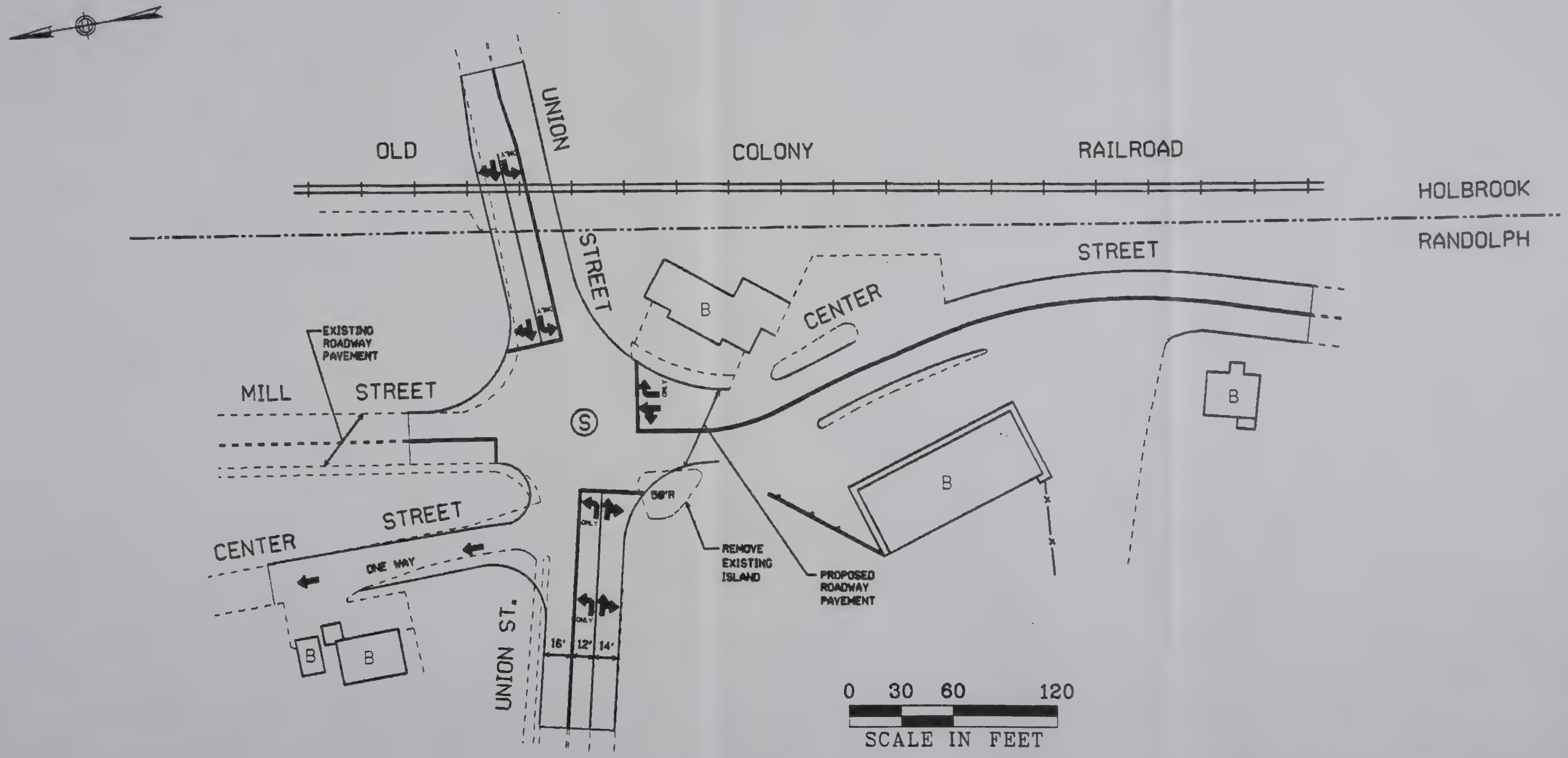
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

HOLBROOK-RANDOLPH: UNION, MILL AND CENTER STREETS

Figure VIII-C3



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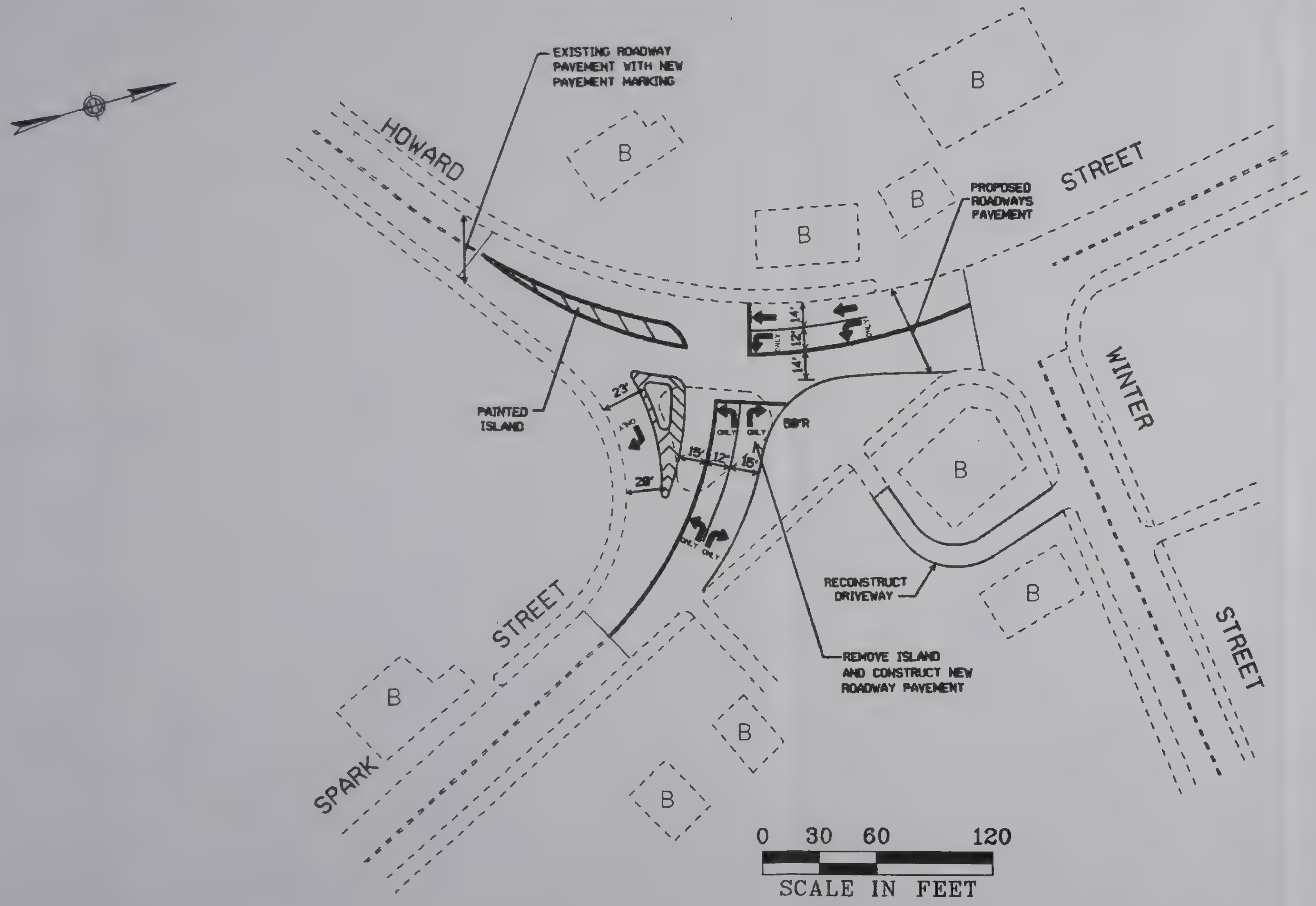
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

MONTELLO:
WINTER, HOWARD
AND SPARK STREET

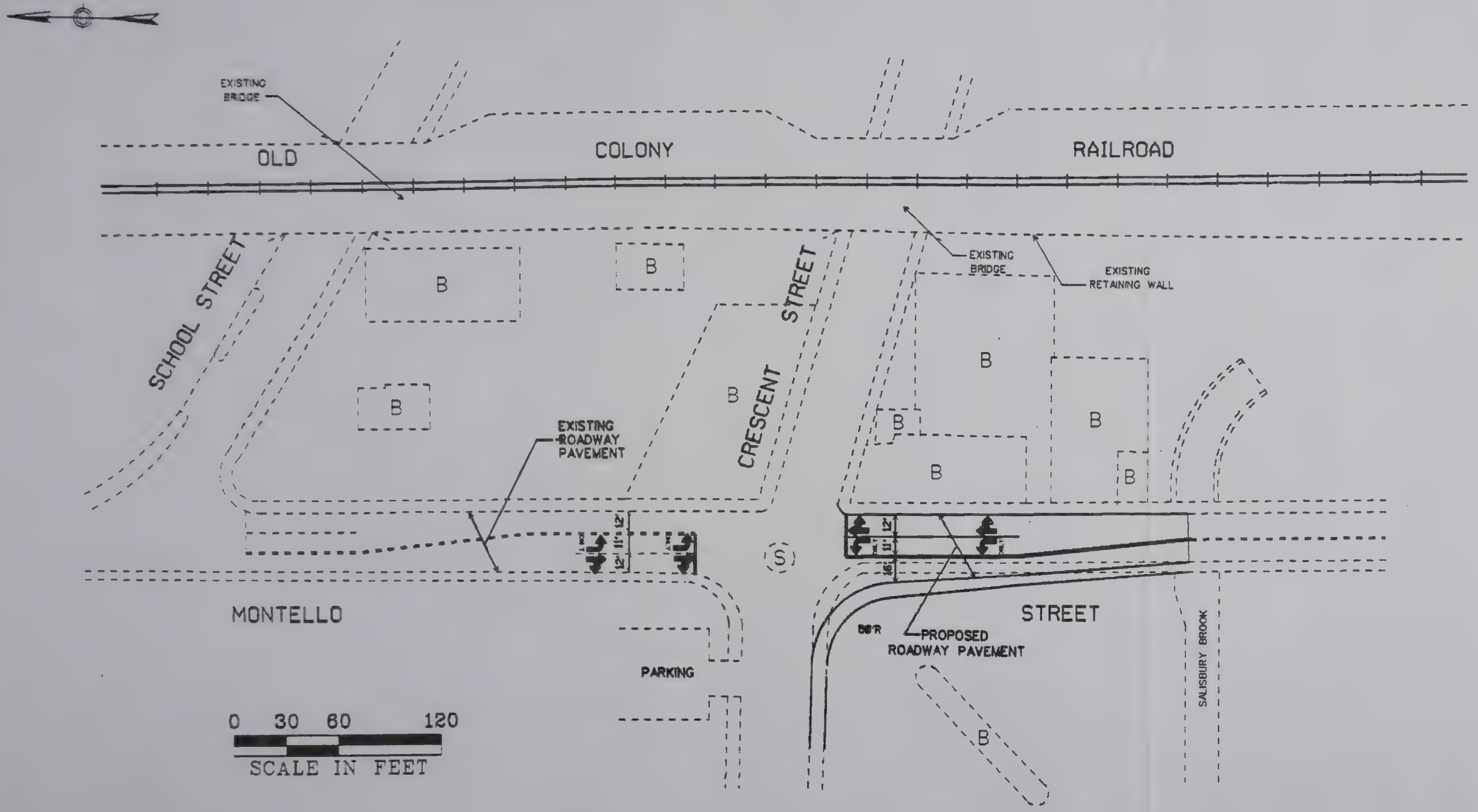
Figure VIII-C4


EXISTING ROADWAY PAVEMENT WITH NEW PAVEMENT MARKING
HOWARD
STREET
B
PROPOSED ROADWAYS PAVEMENT
WINTER
STREET
14'
12'
14'
ONLY
PAINTED ISLAND
23'
29'
15'
12'
15'
50'R
RECONSTRUCT DRIVEWAY
REMOVE ISLAND AND CONSTRUCT NEW ROADWAY PAVEMENT
SPARK
STREET
0
30
60
120
SCALE IN FEET

CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

BROCKTON: CRESCENT AND MONTELLO STREET

Figure VIII-C5



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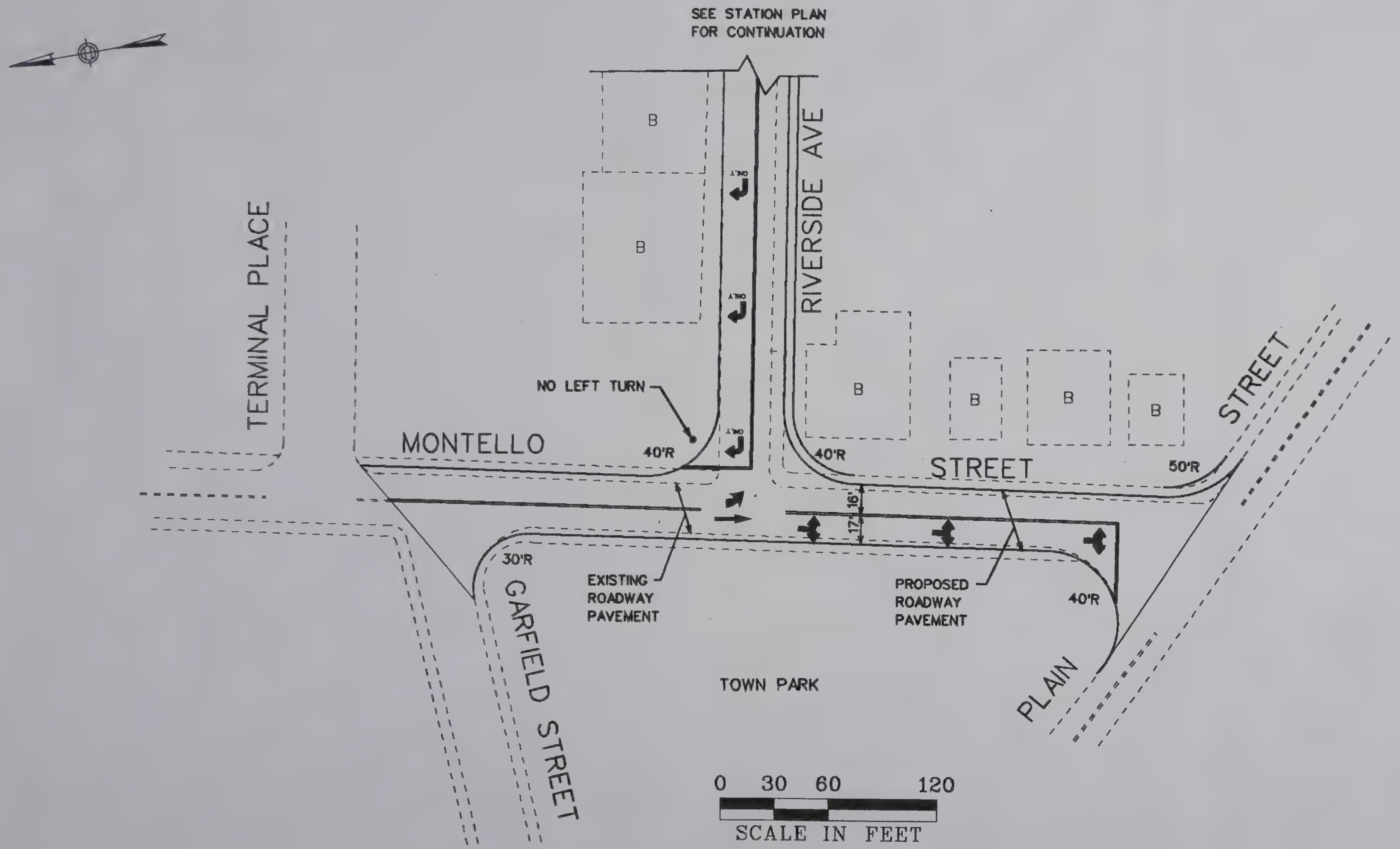
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

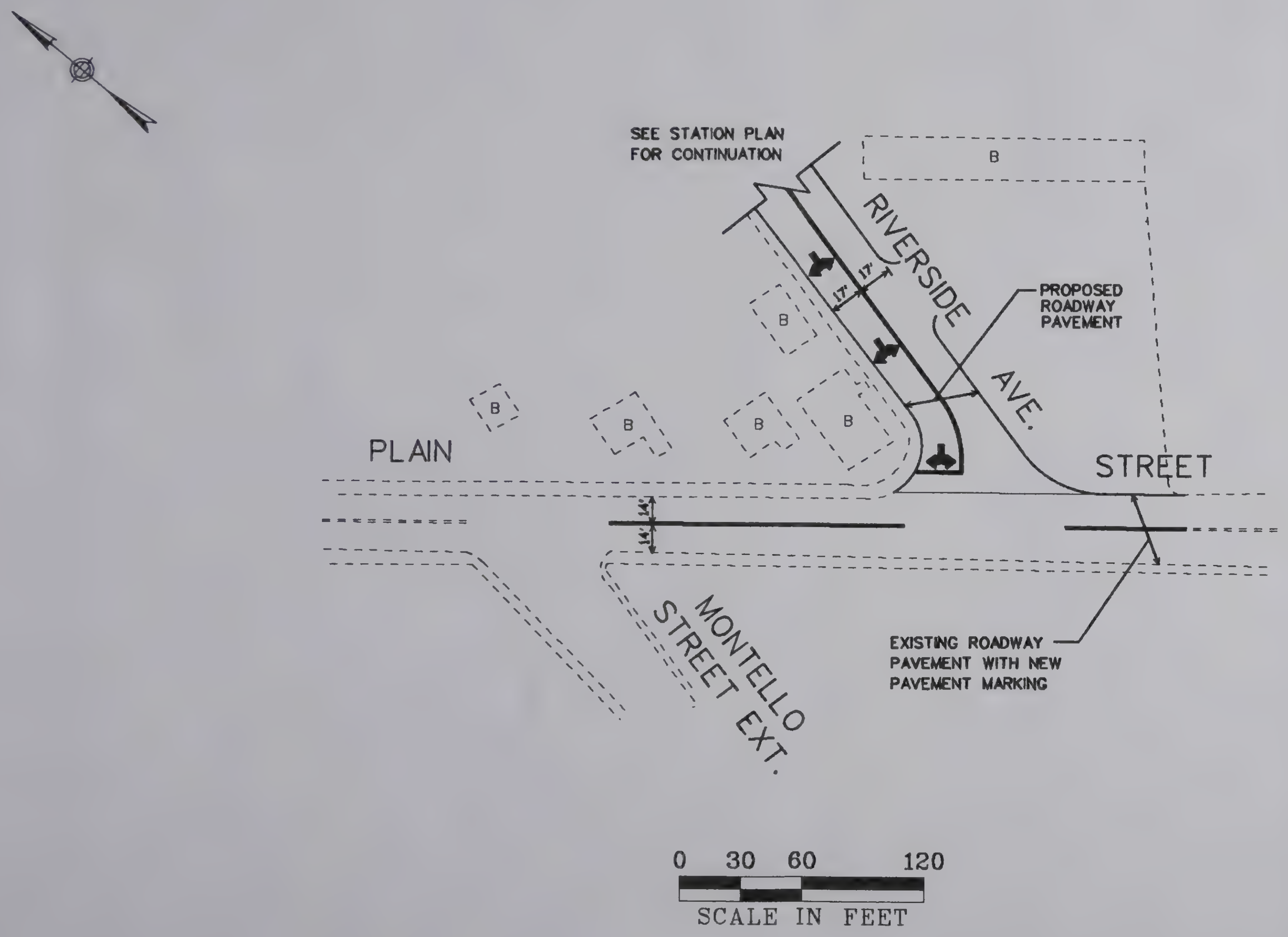
CAMPELLO:
MONTELLO STREET AND
RIVERSIDE AVENUE

Figure VIII-C6



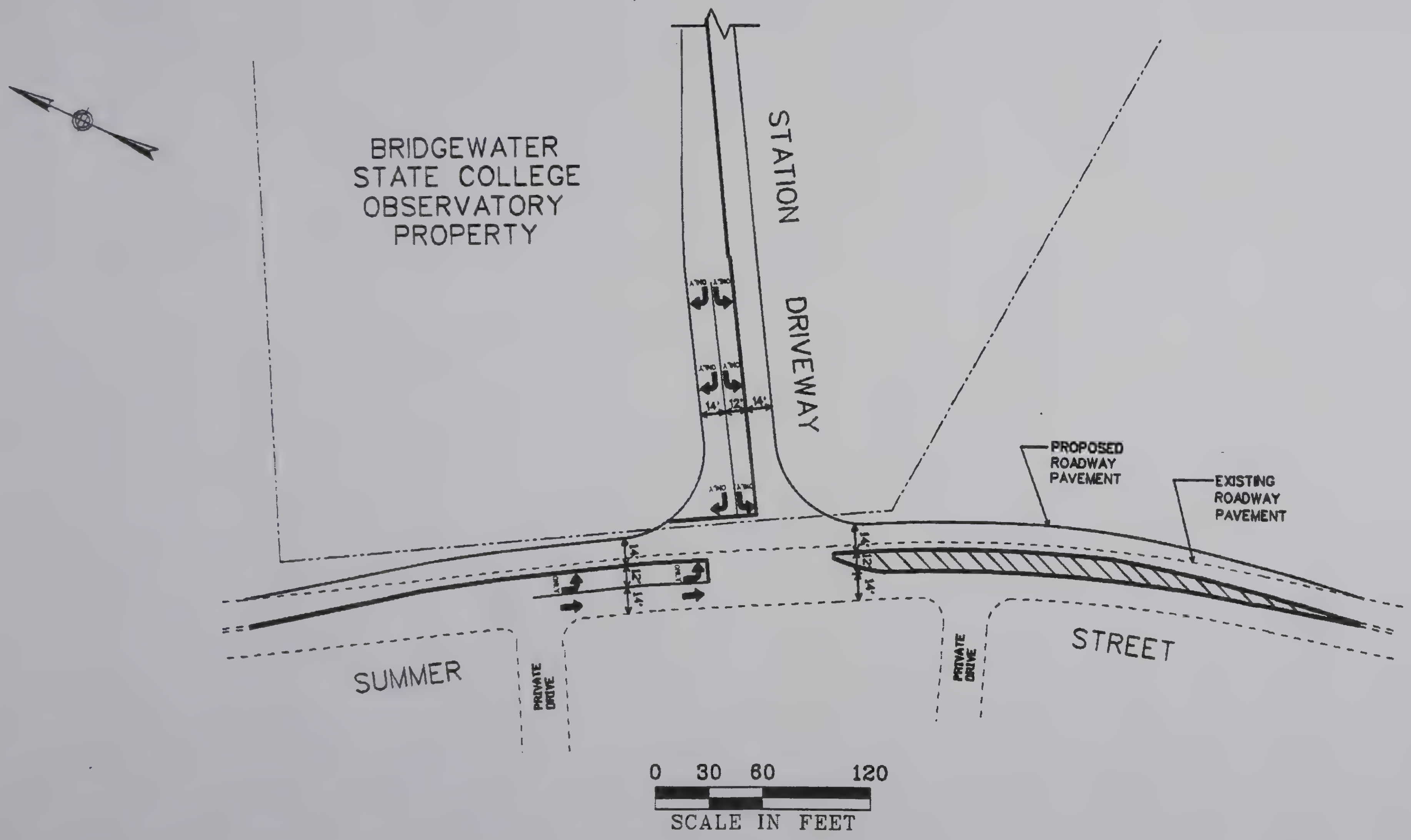
CAMPELLO:
PLAIN STREET AND RIVERSIDE AVENUE

Figure VIII-C7


SEE STATION PLAN FOR CONTINUATION
B
RIVERSIDE
AVE.
17'
17'
PROPOSED ROADWAY PAVEMENT
B
B
B
B
B
PLAIN
STREET
14'
14'
MONTELLO
STREET EXT.
EXISTING ROADWAY PAVEMENT WITH NEW PAVEMENT MARKING
0
30
60
120
SCALE IN FEET

BRIDGEWATER: SUMMER STREET AND STATION DRIVEWAY

Figure VIII-C8


BRIDGEWATER STATE COLLEGE OBSERVATORY PROPERTY
STATION DRIVEWAY
ONLY
14'
12'
14'
PROPOSED ROADWAY PAVEMENT
EXISTING ROADWAY PAVEMENT
SUMMER
STREET
PRIVATE DRIVE
PRIVATE DRIVE
0
30
60
120
SCALE IN FEET

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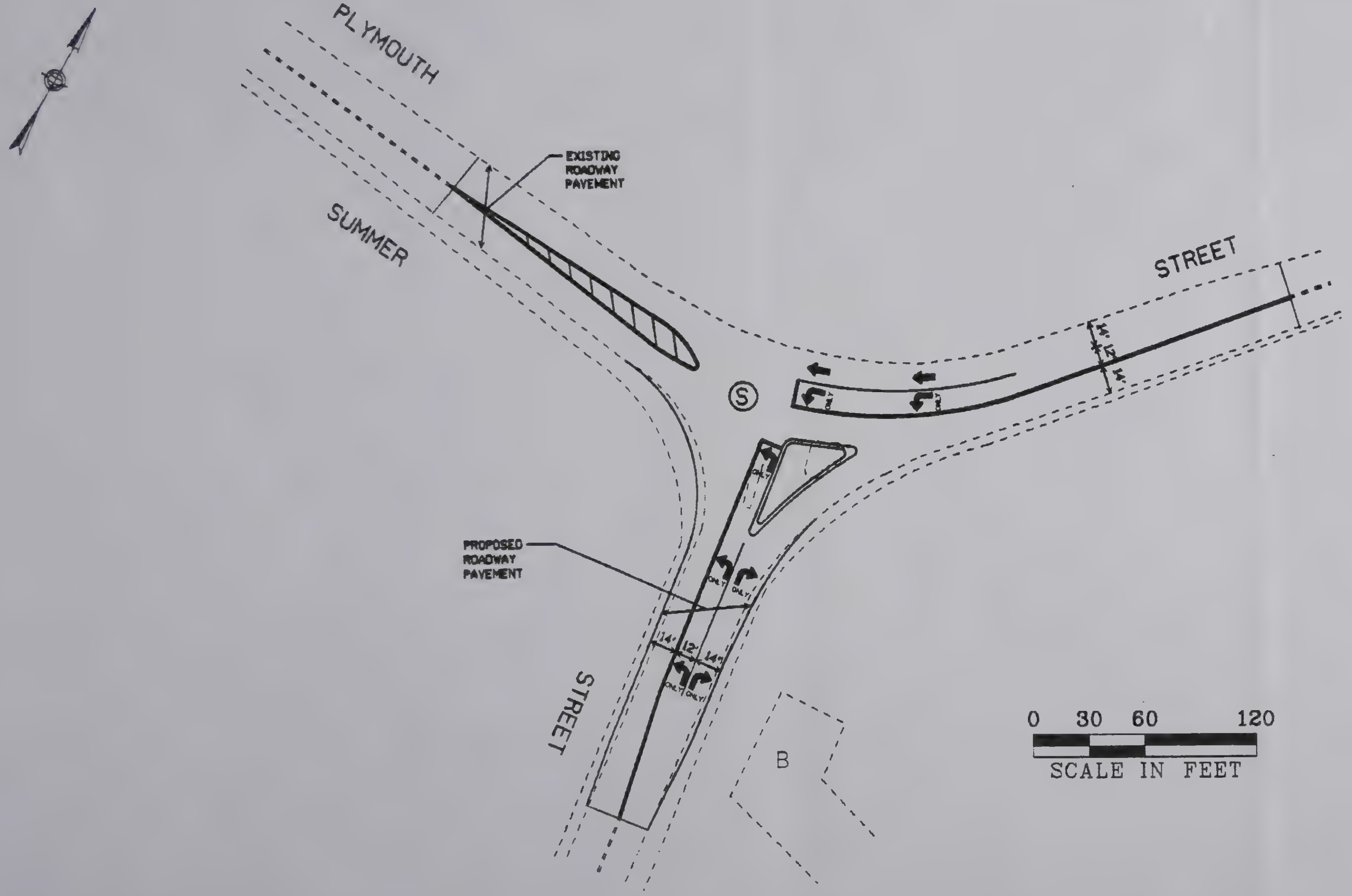
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

BRIDGEWATER:
PLYMOUTH AND
SUMMER STREET

Figure VIII-C9



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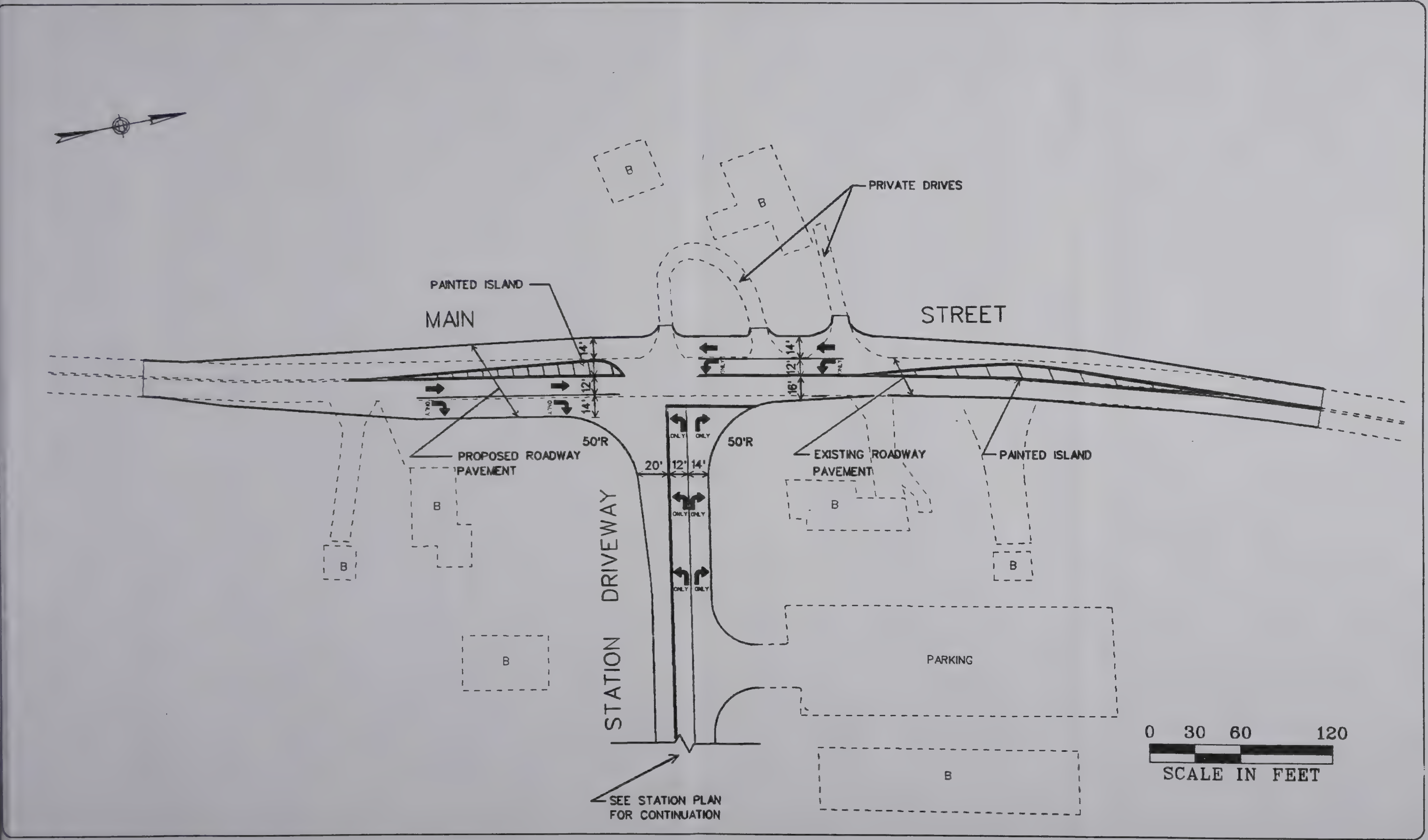
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

LAKEVILLE:
MAIN STREET (ROUTE 105)
AND STATION DRIVEWAY

Figure VIII-C10



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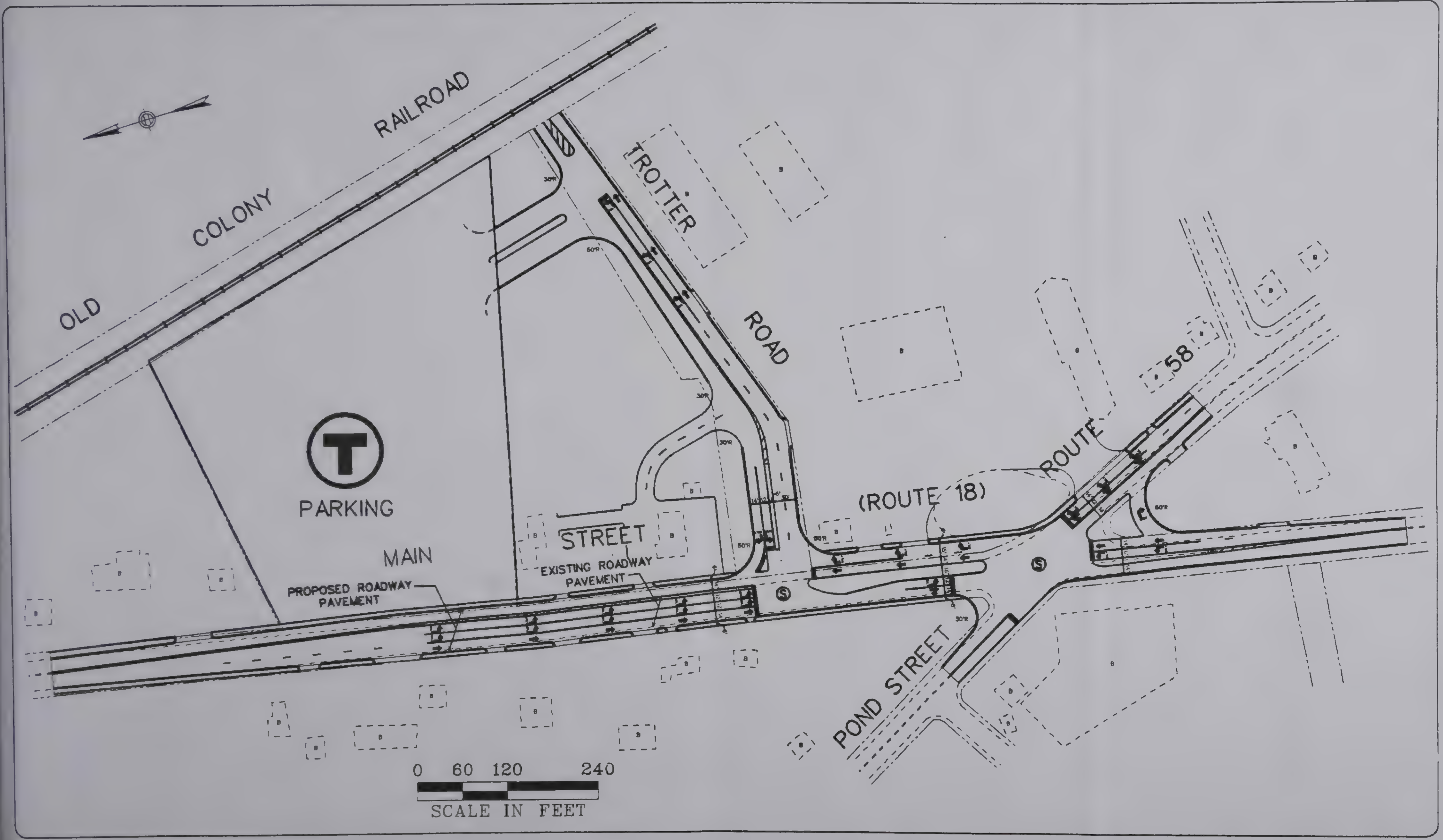
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

SOUTH WEYMOUTH:
ROUTE 18, ROUTE 58
AND POND STREET

Figure VIII-C11a



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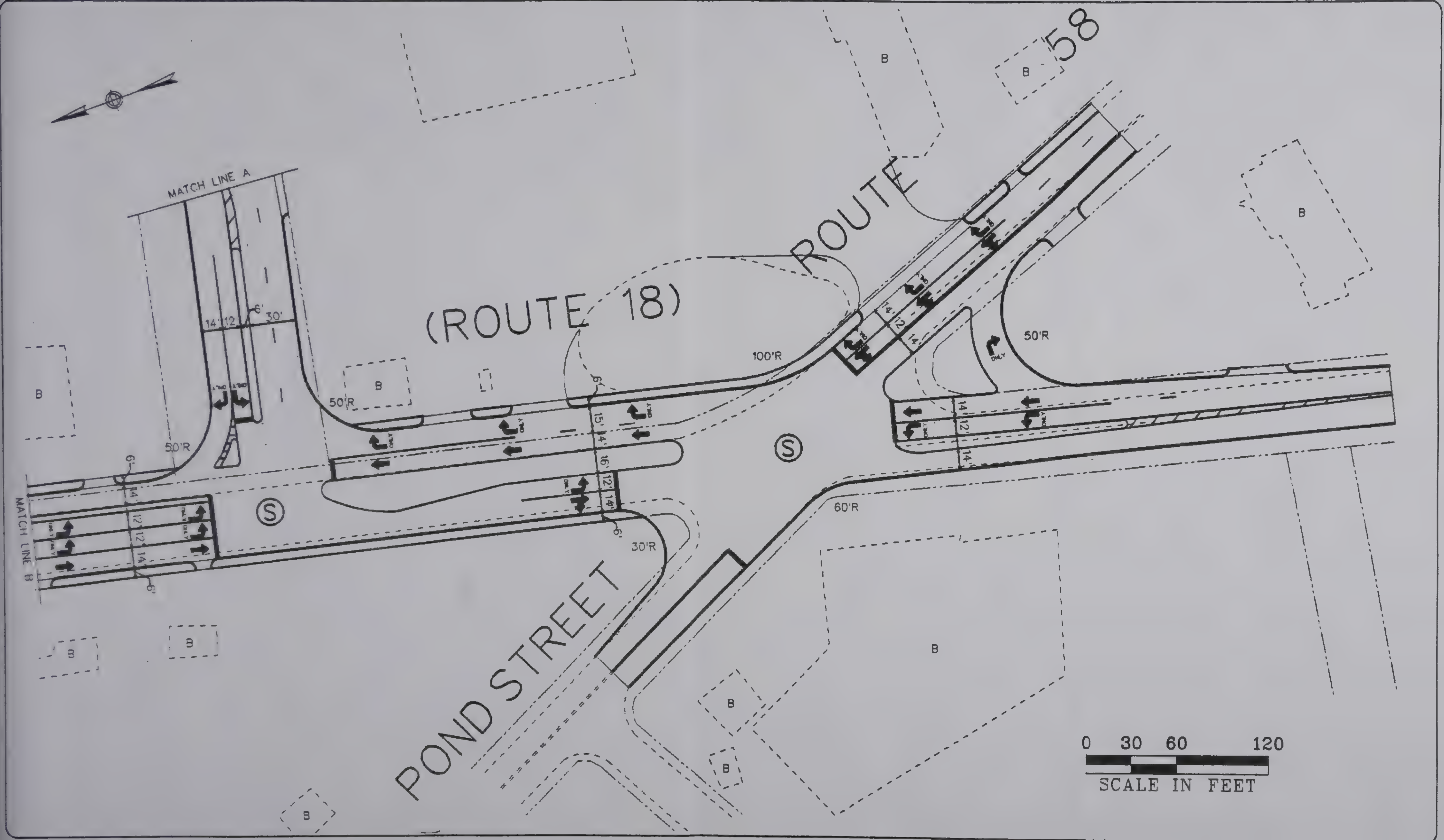
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

SOUTH WEYMOUTH:
ROUTE 18, ROUTE 58
AND POND STREET

Figure VIII-C11b



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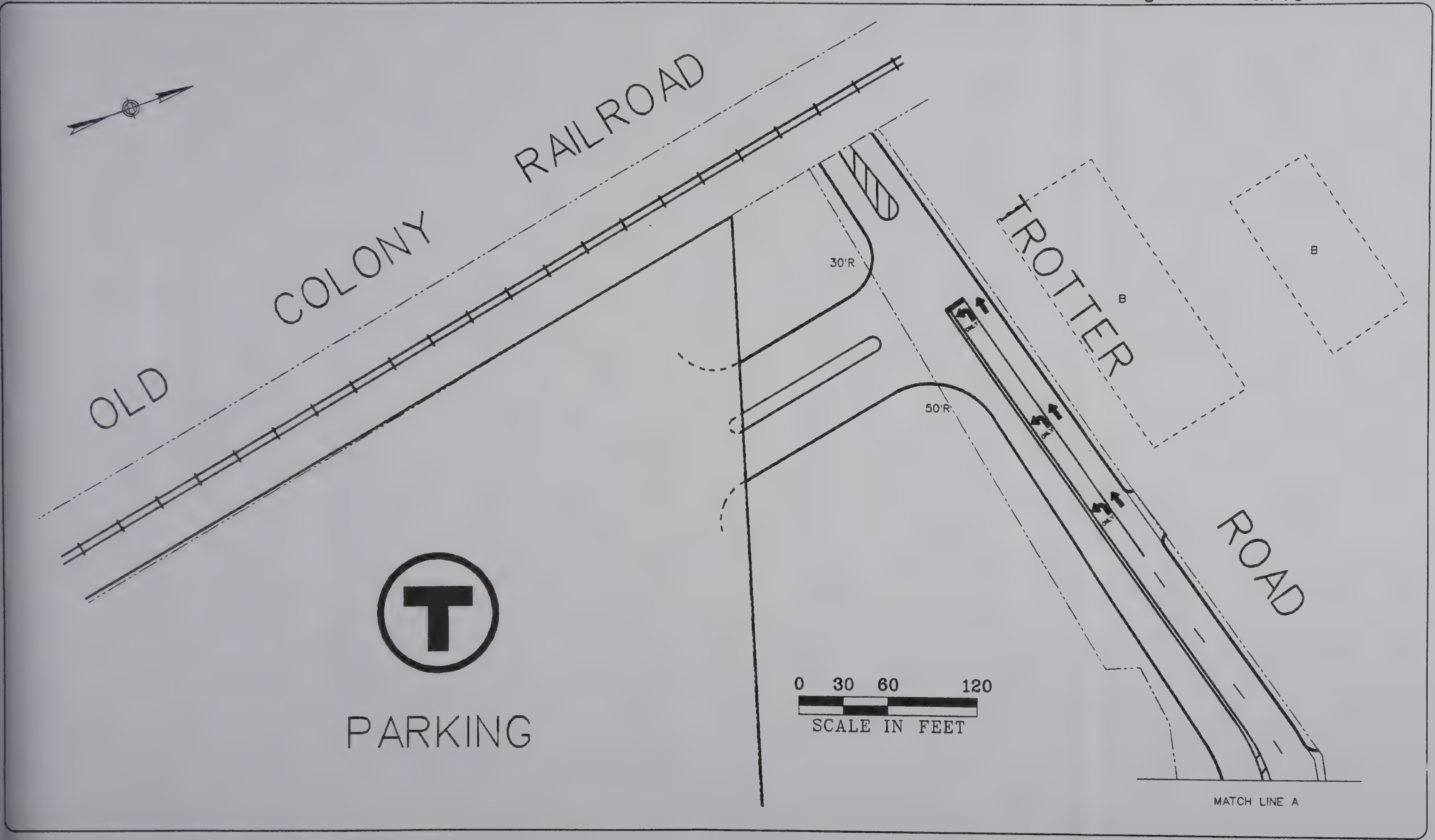
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

SOUTH WEYMOUTH:
ROUTE 18, ROUTE 58
AND POND STREET

Figure VIII-C11c



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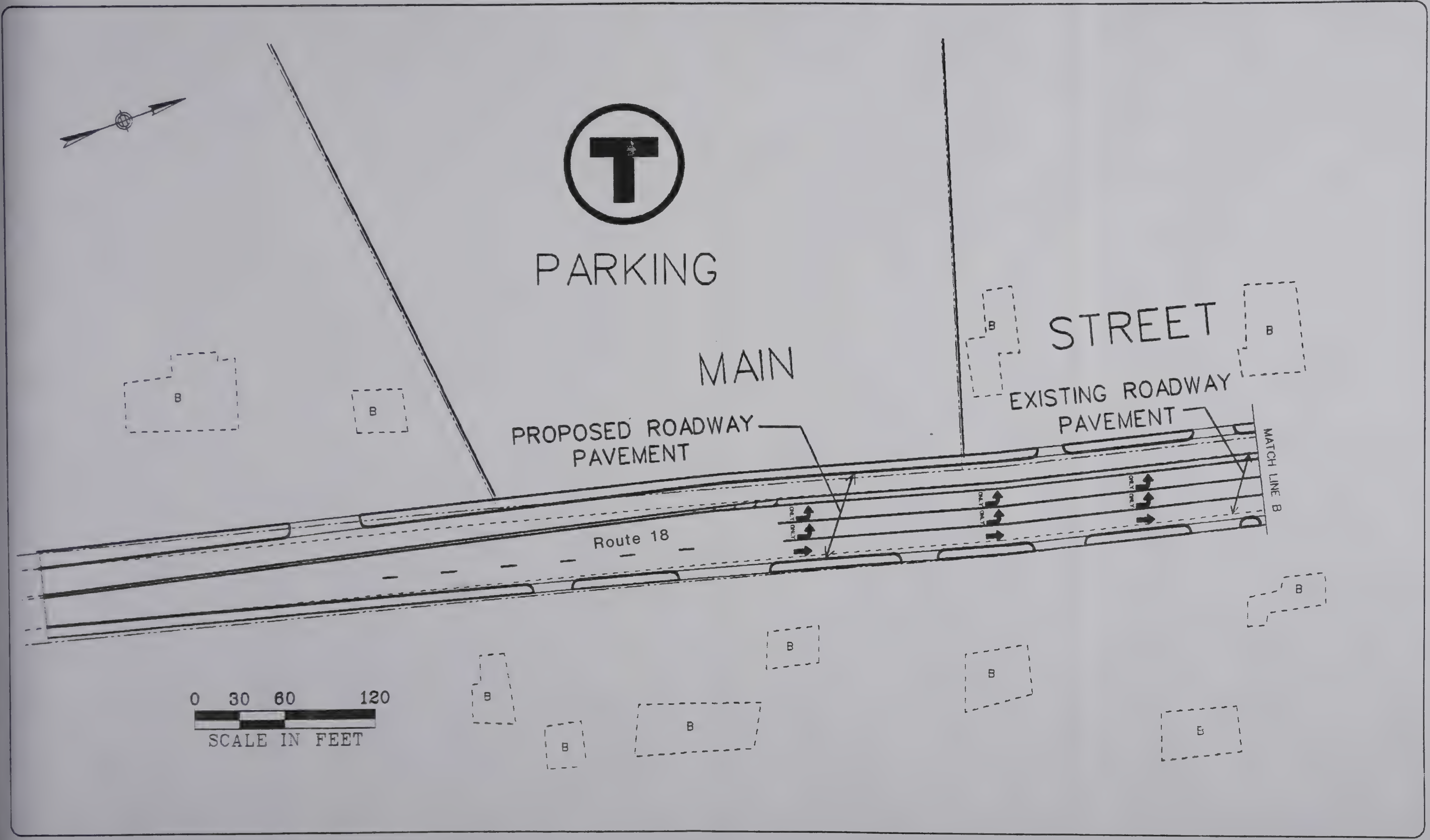
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

SOUTH WEYMOUTH:
ROUTE 18, ROUTE 58
AND POND STREET

Figure VIII-C11d



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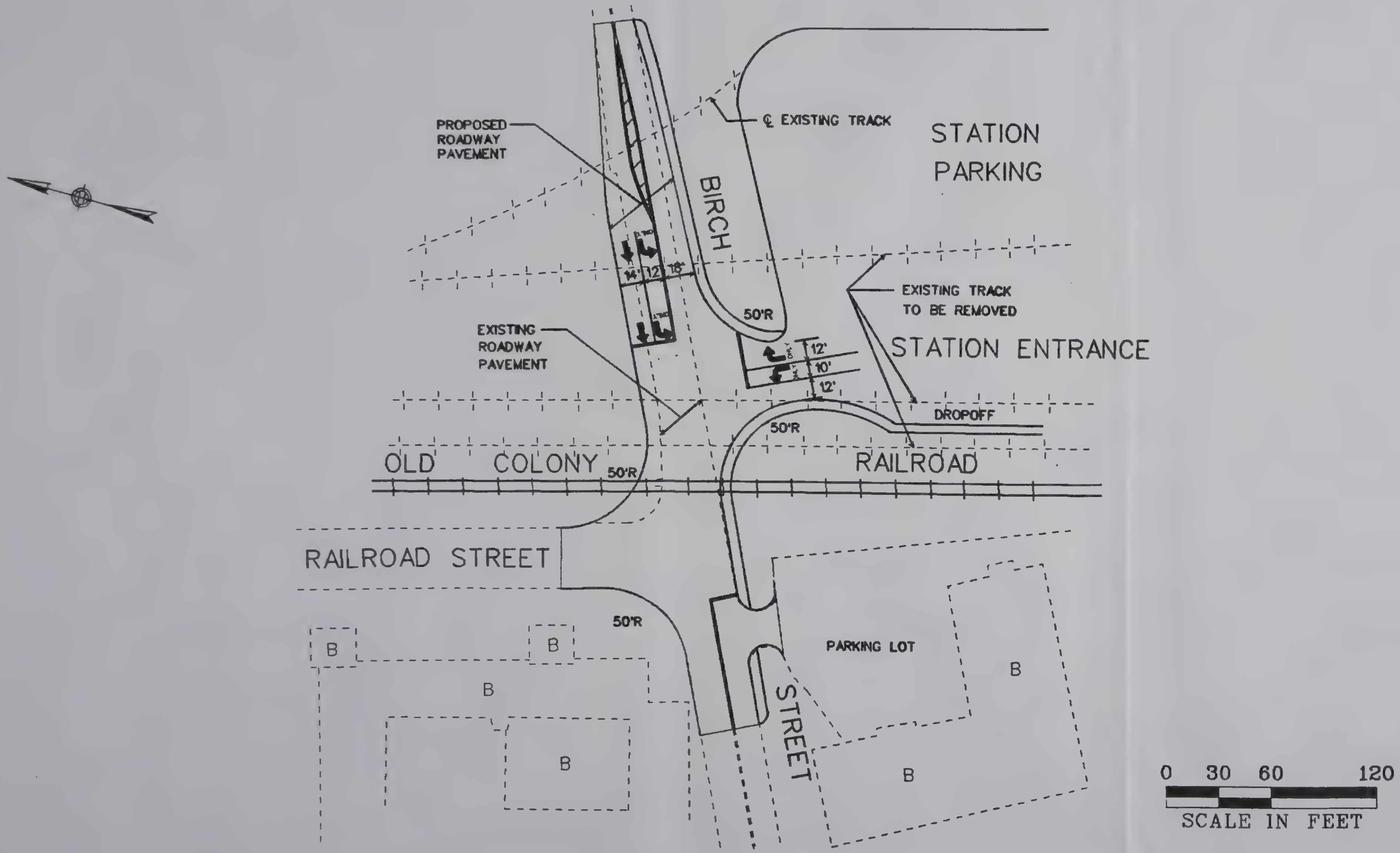
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

ABINGTON:
BIRCH STREET AND STATION ENTRANCE

Figure VIII-C12



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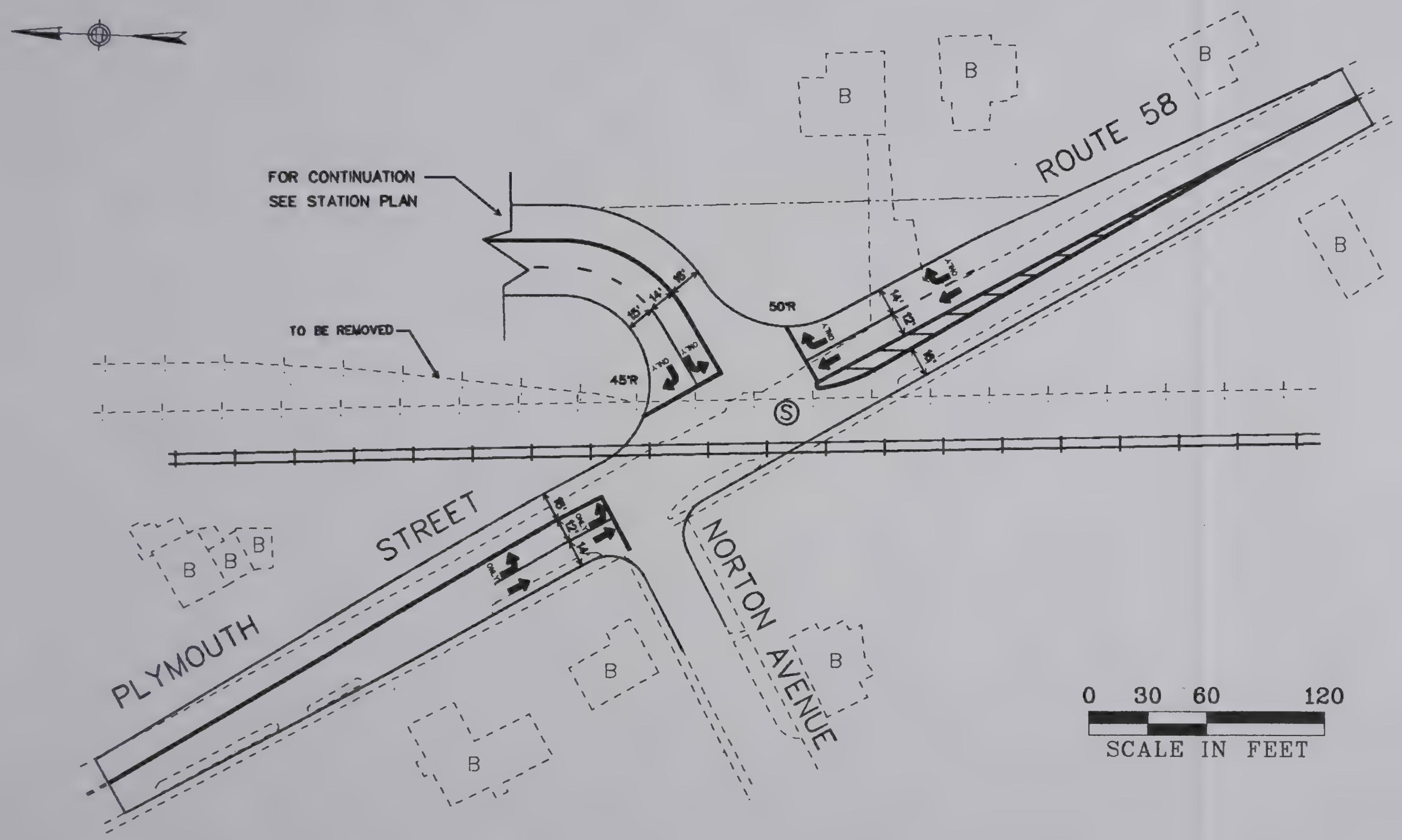
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

ABINGTON: PLYMOUTH STREET (ROUTE 58) AND STATION DRIVEWAY

Figure VIII-C13



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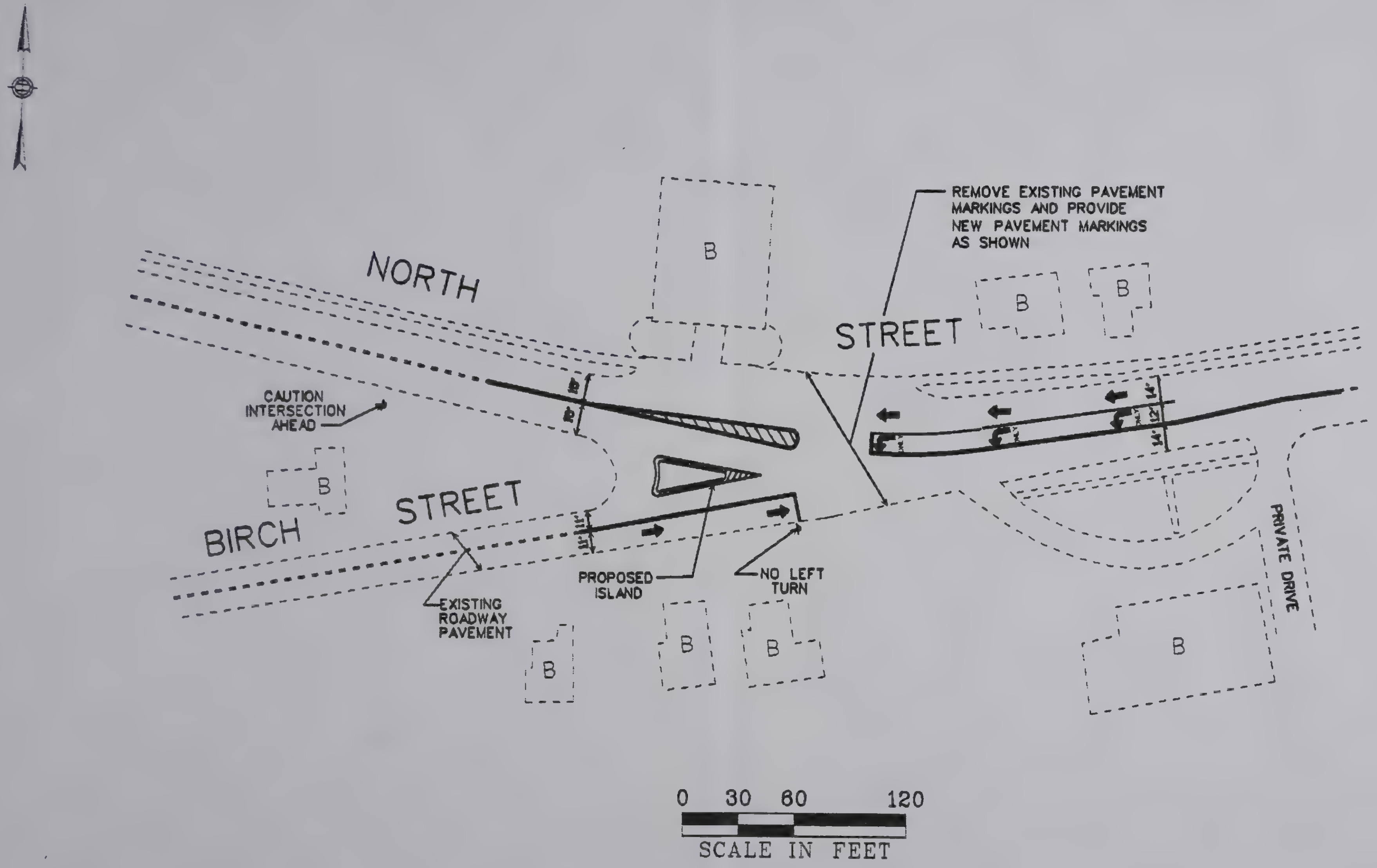
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

ABINGTON:
NORTH AND
BIRCH STREET

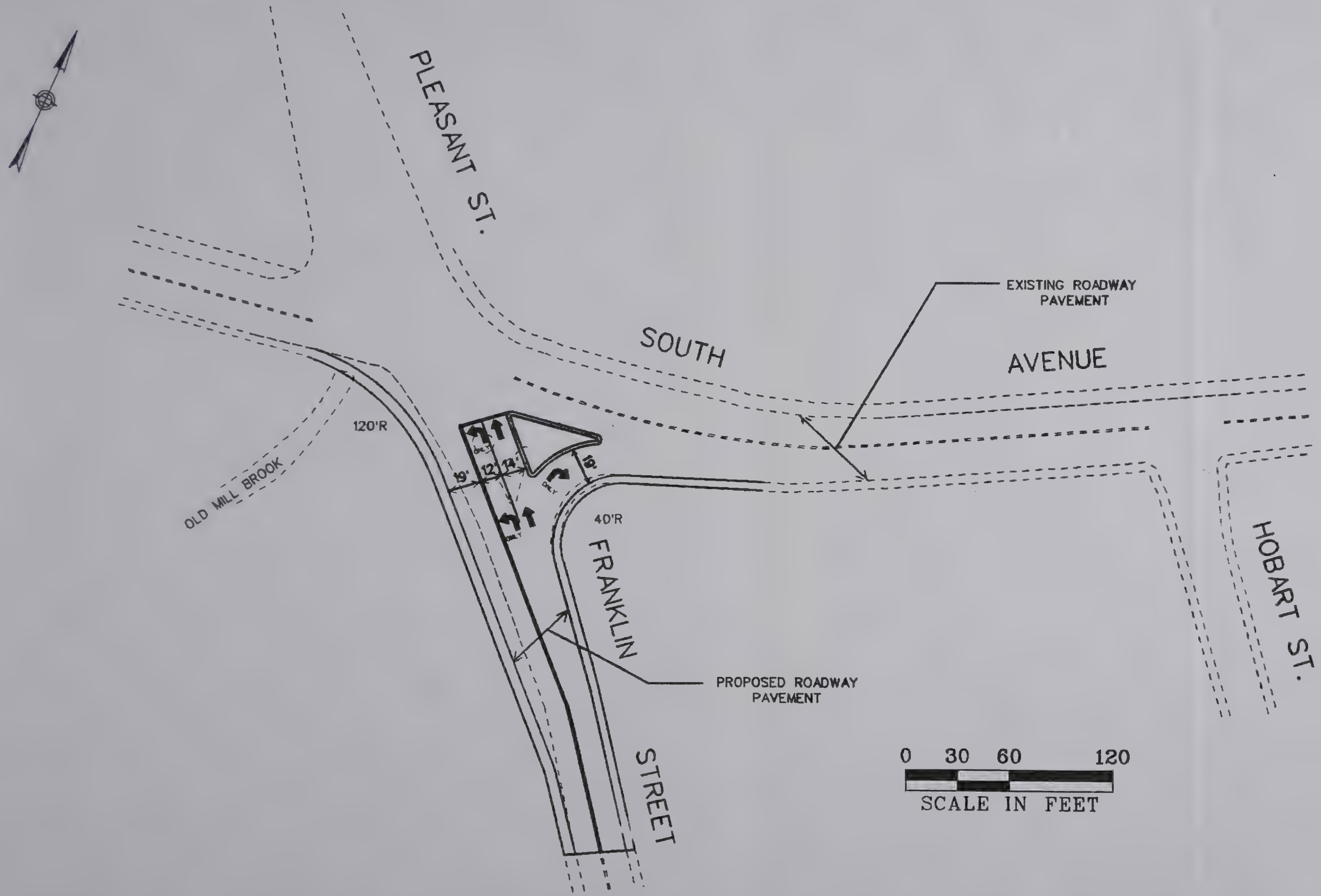
Figure VIII-C14


NORTH
STREET
BIRCH
STREET
REMOVE EXISTING PAVEMENT MARKINGS AND PROVIDE NEW PAVEMENT MARKINGS AS SHOWN
CAUTION INTERSECTION AHEAD
PROPOSED ISLAND
NO LEFT TURN
EXISTING ROADWAY PAVEMENT
PRIVATE DRIVE
B
B
B
B
B
B
B
B
B
14'
12'
14'
11'
11'
0
30
60
120
SCALE IN FEET

CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

WHITMAN:
PLEASANT, SOUTH
AND FRANKLIN STREETS

Figure VIII-C15



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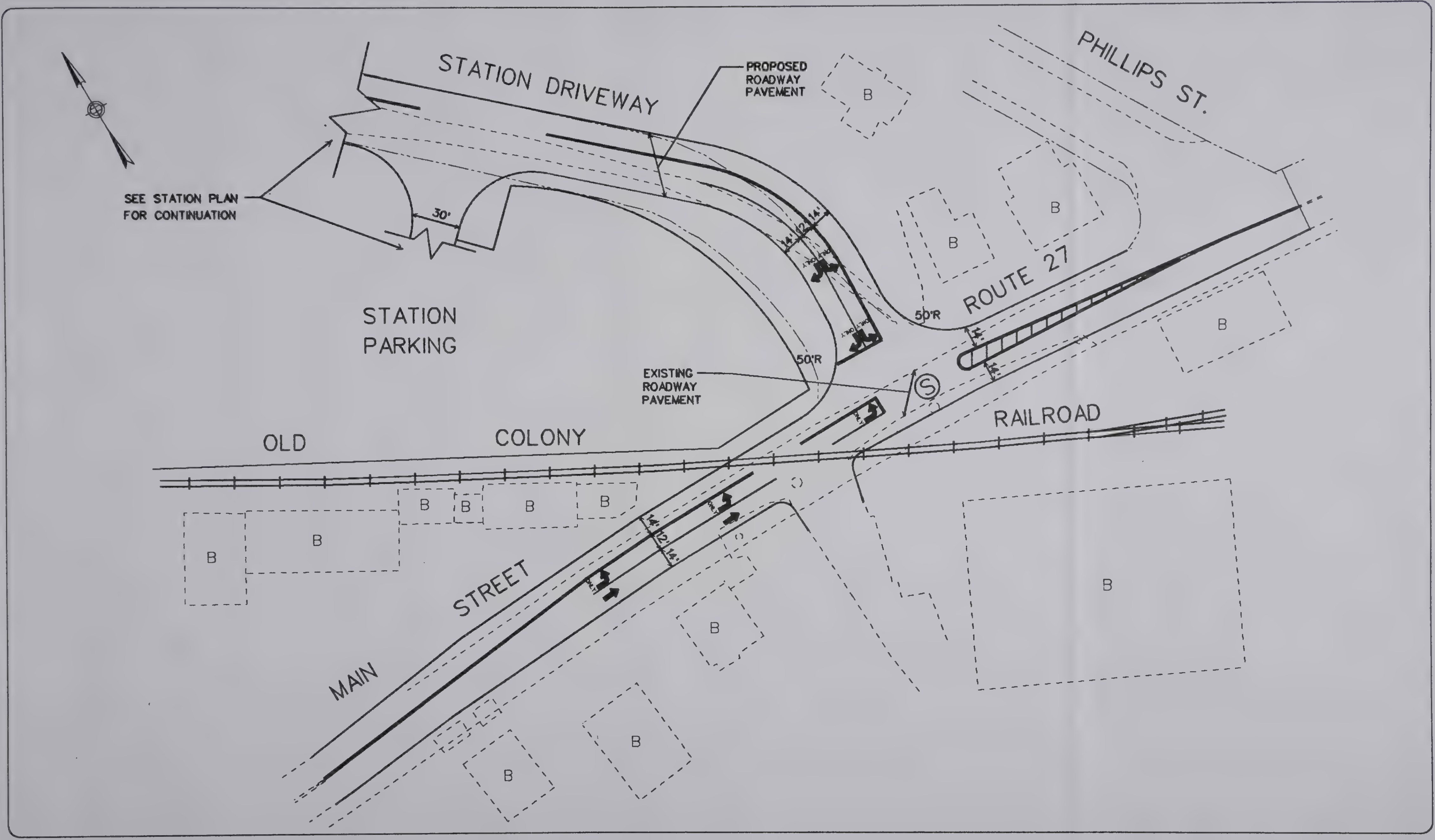
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

HANSON: MAIN STREET AT STATION ENTRANCE

Figure VIII-C16



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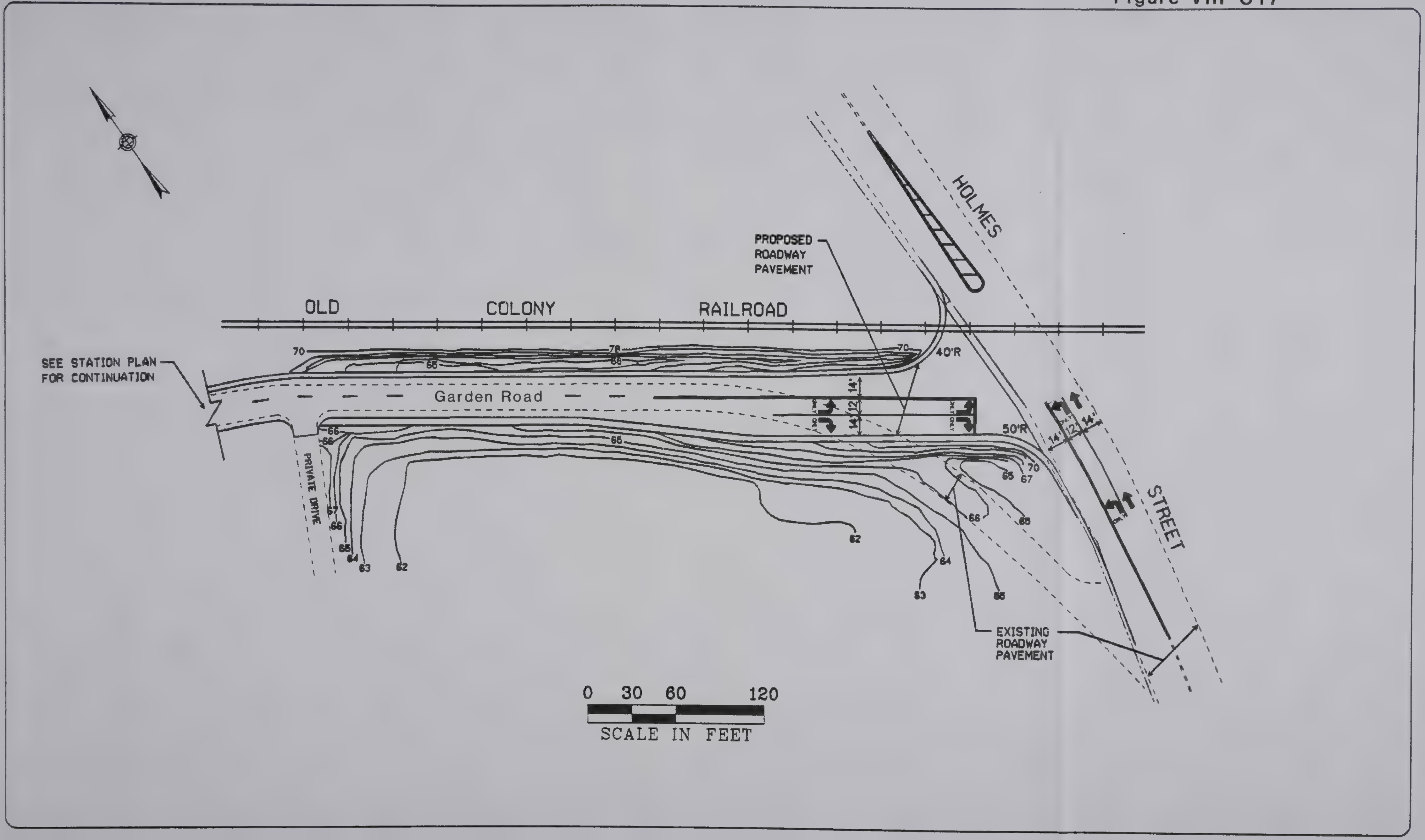
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

HALIFAX:
HOLMES STREET AND GARDEN ROAD

Figure VIII-C17



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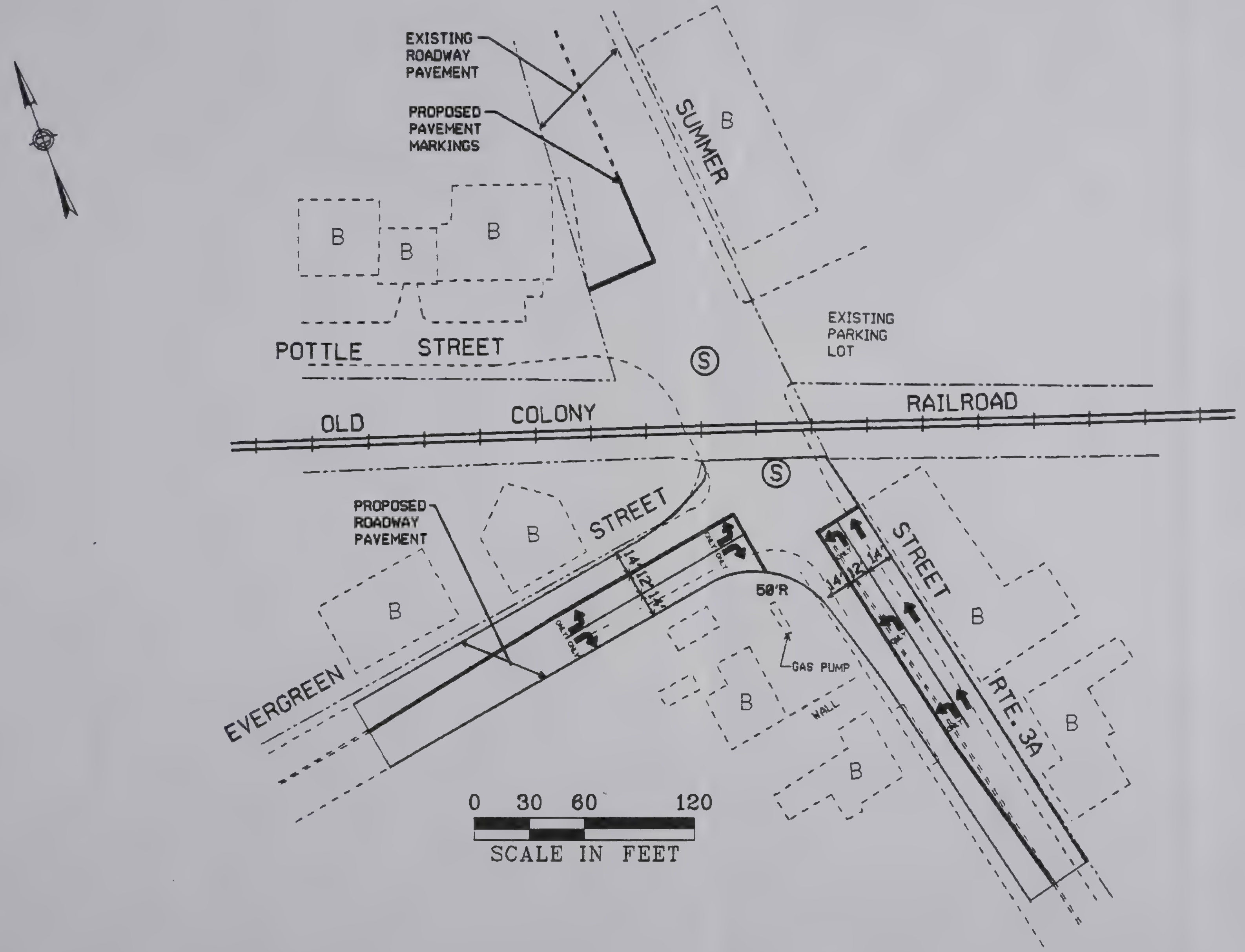
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

KINGSTON: ALT. 1
EVERGREEN AND
SUMMER STREET (RTE. 3A)

Figure VIII-C18a



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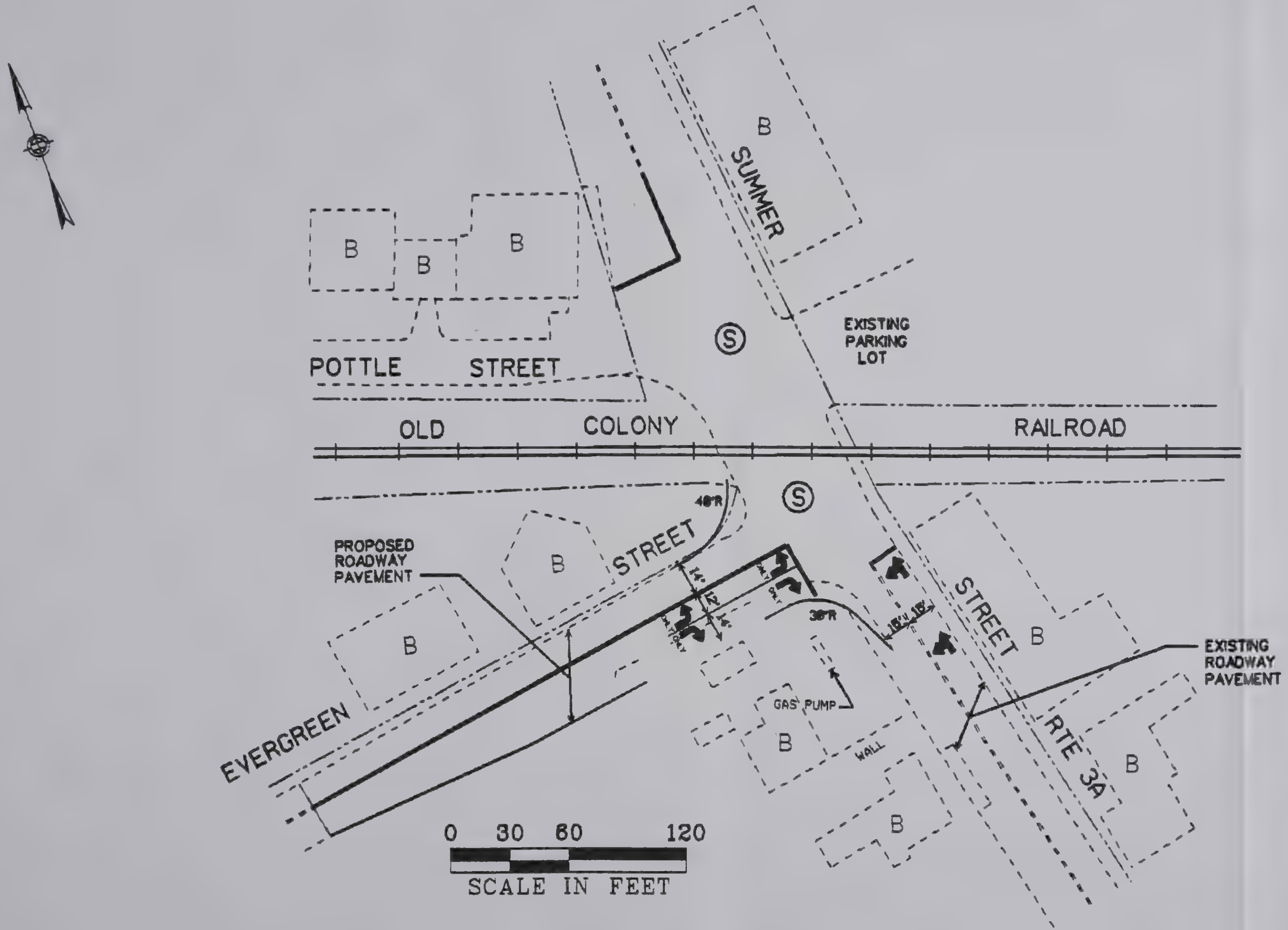
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

KINGSTON: ALT. 2
EVERGREEN AND
SUMMER ST. (3A)

Figure VIII-C18b



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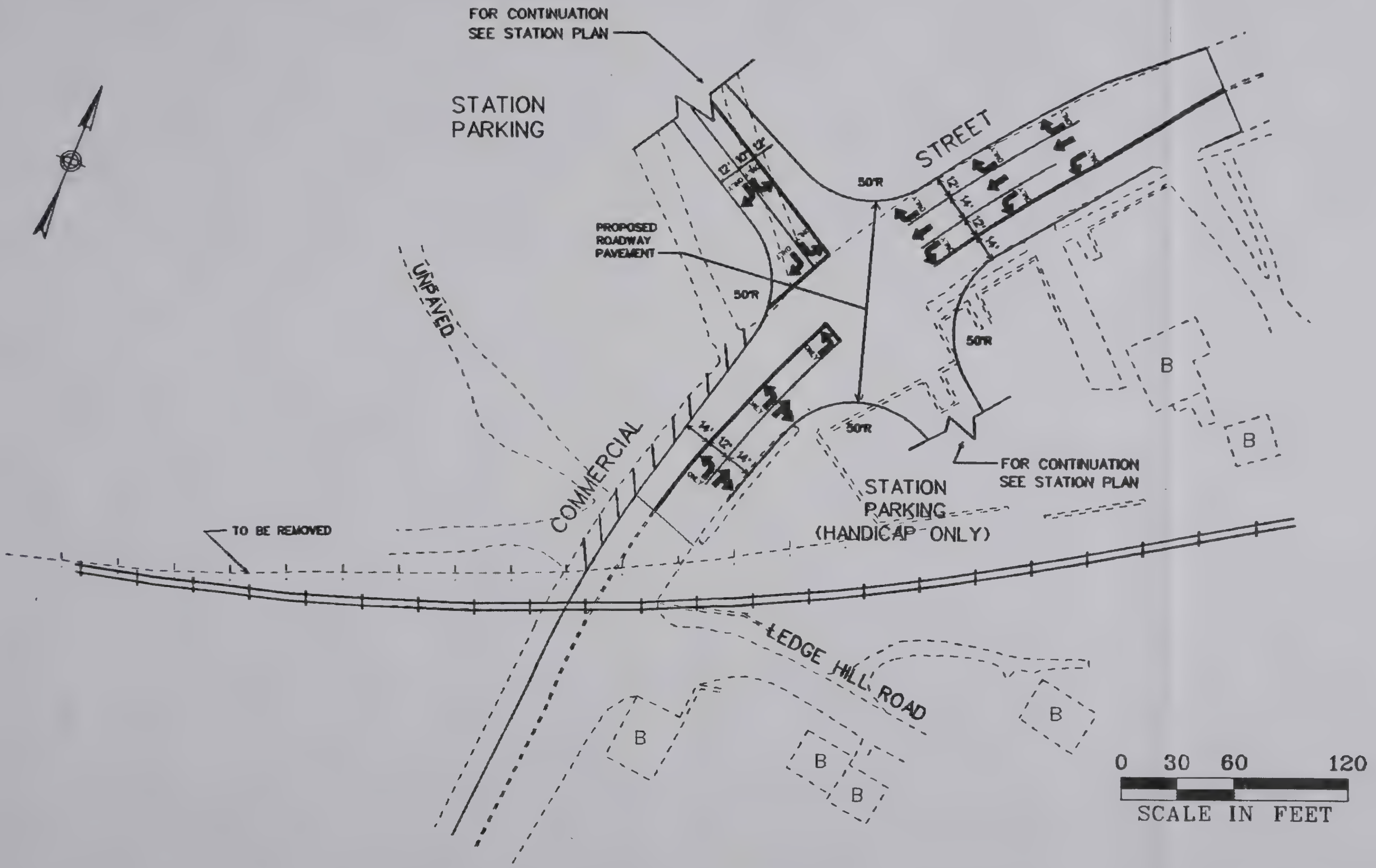
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

WEYMOUTH LANDING:
COMMERCIAL STREET
AND STATION ENTRANCE

Figure VIII-C19



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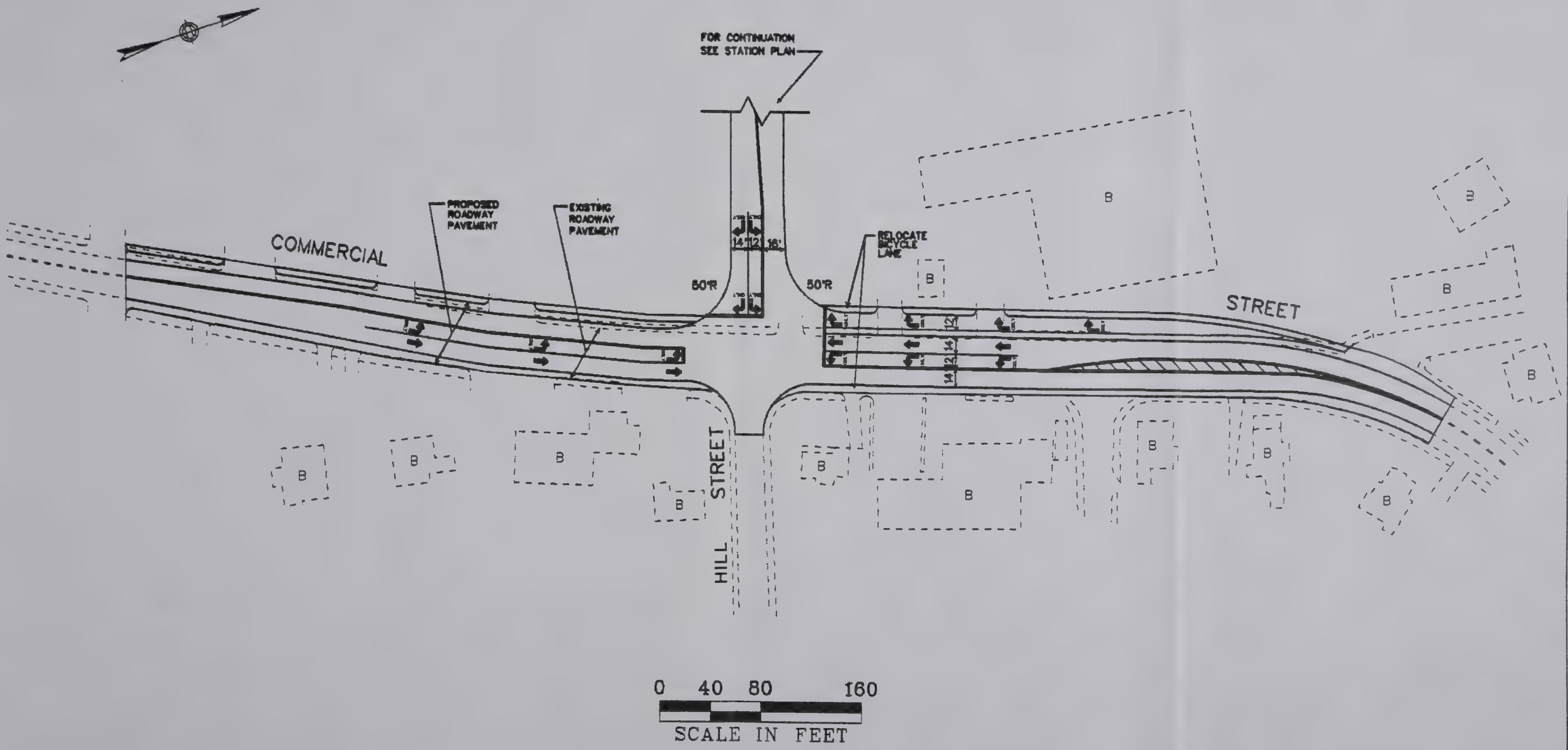
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

EAST WEYMOUTH:
COMMERCIAL STREET
AND HAWKINS STREET

Figure VIII-C20



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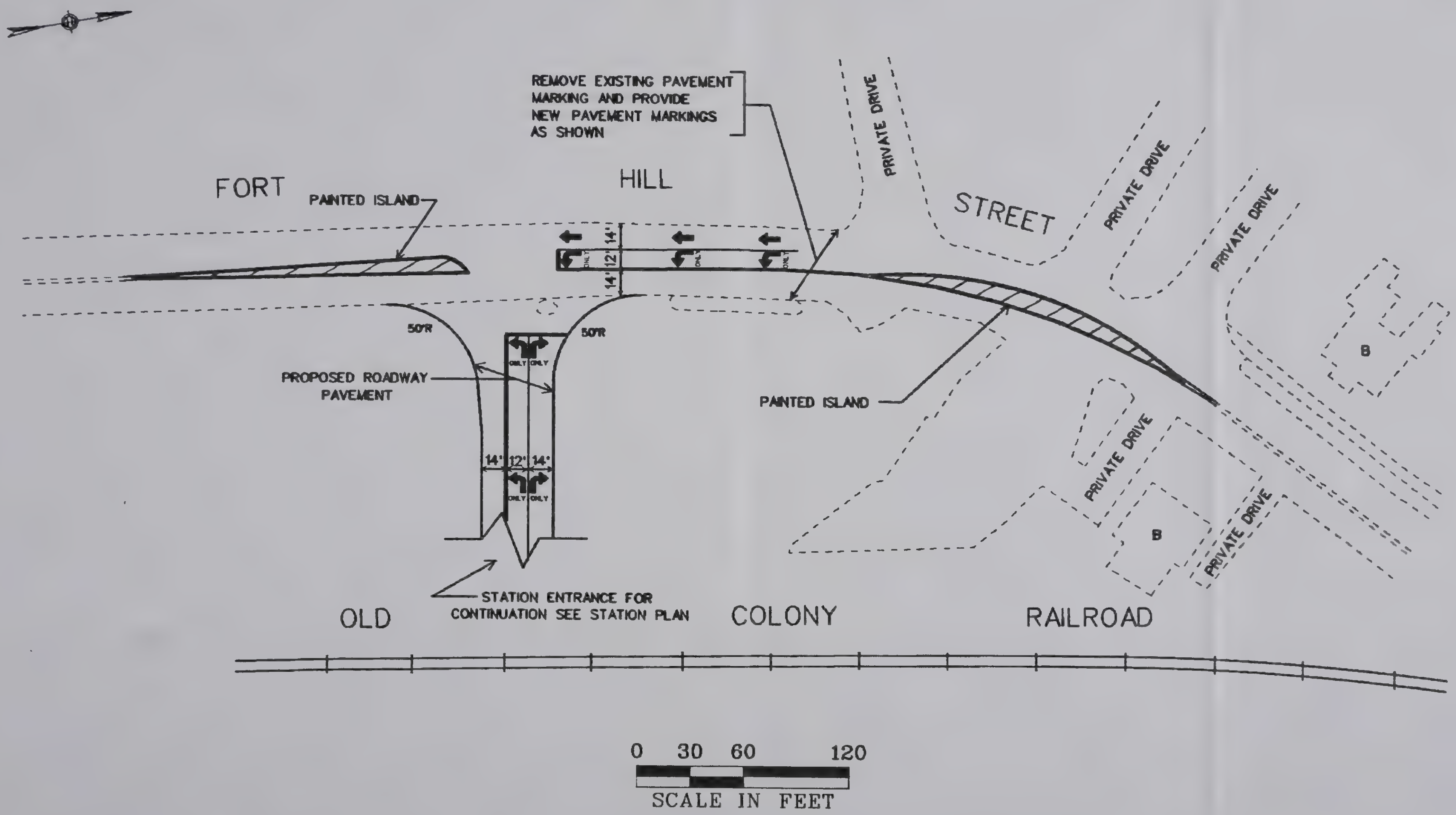
Old Colony Railroad Rehabilitation Project

CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

WEST HINGHAM:
FORT HILL STREET
AND STATION DRIVEWAY

Figure VIII-C21



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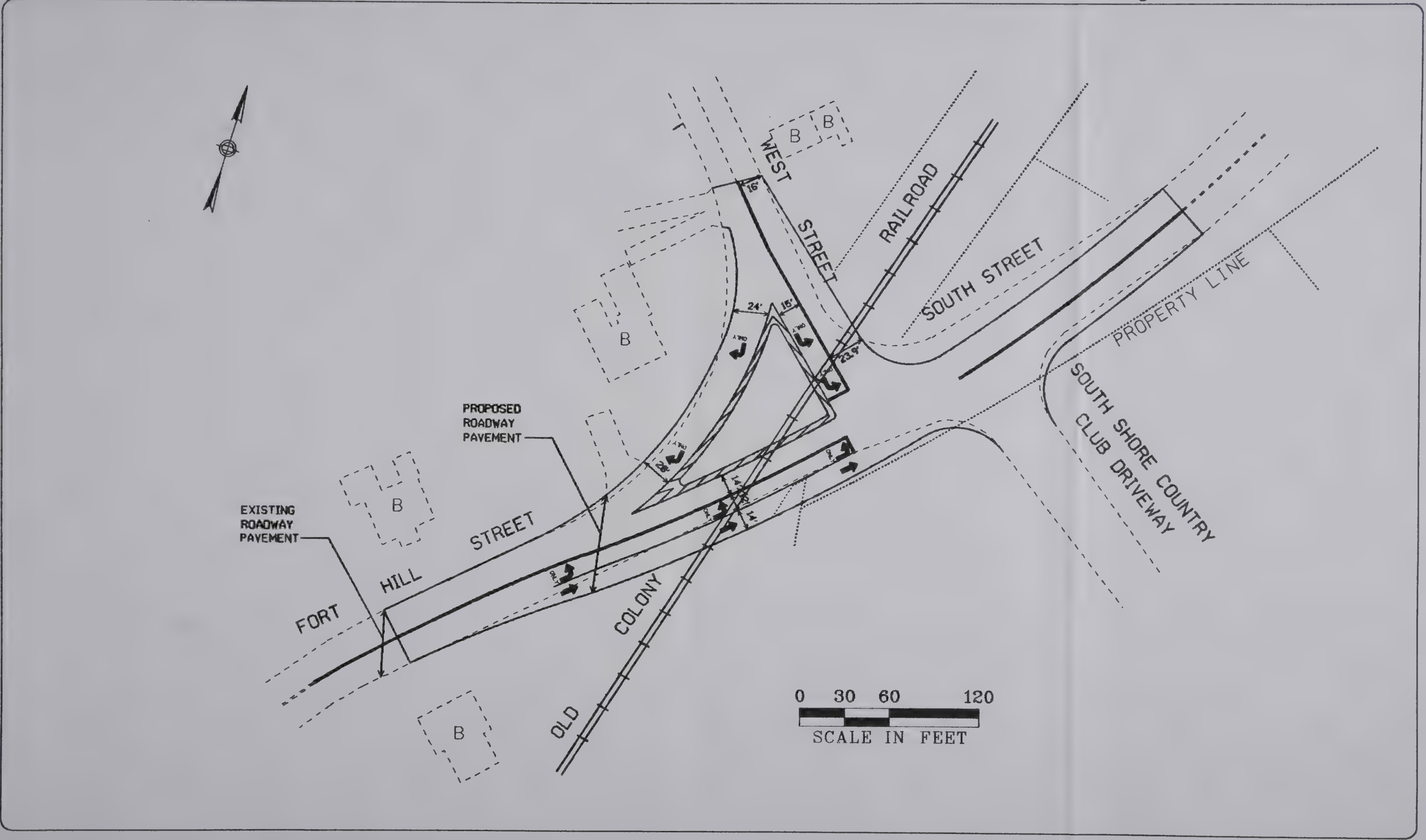
CONCEPTUAL PLANS FOR STATION ACCESS AND INTERSECTION IMPROVEMENTS

WEST HINGHAM:
FORT HILL AND
WEST STREETS

Figure VIII-C22



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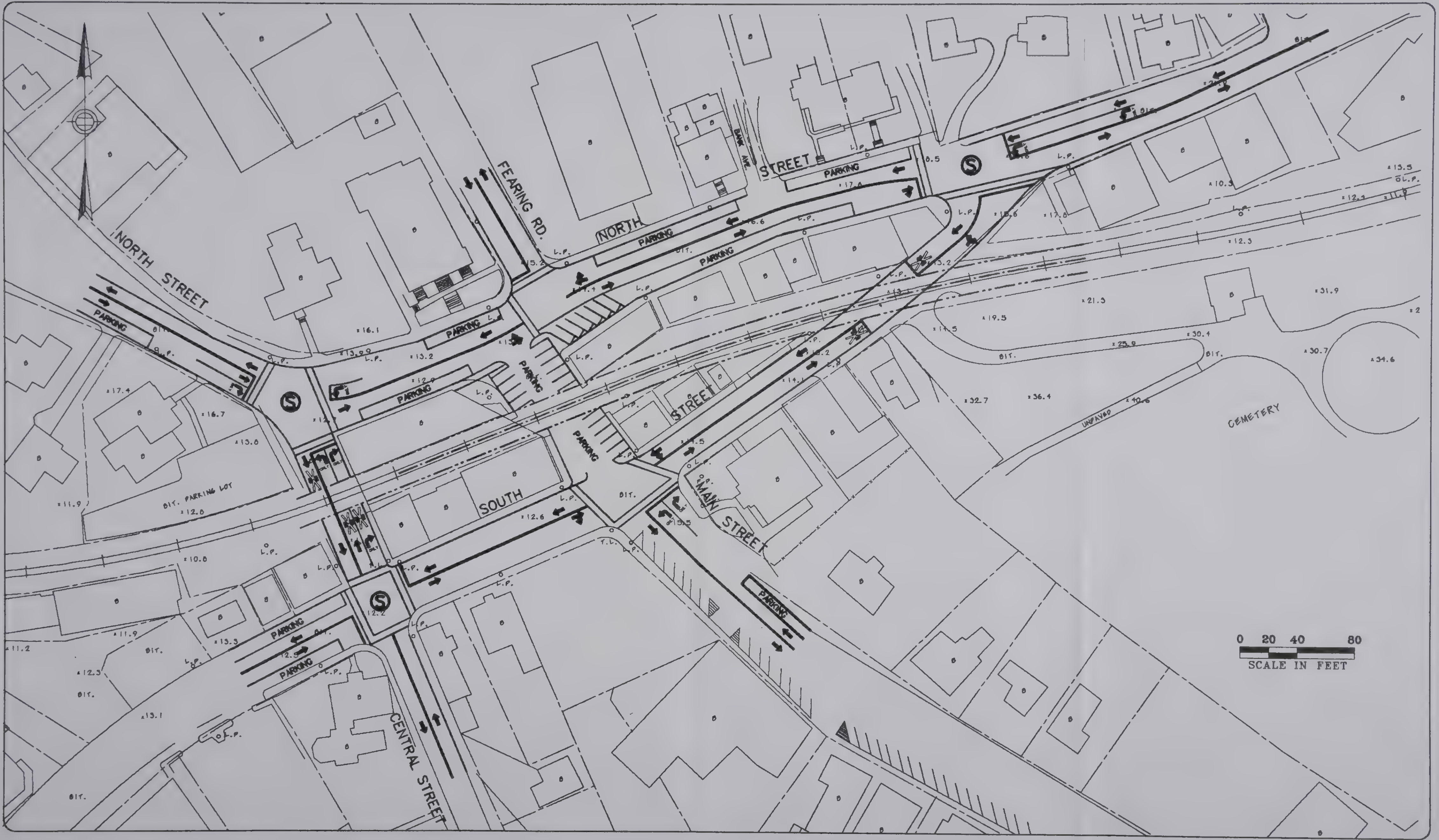
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

HINGHAM SQUARE - ALT. 1

Figure VIII-C23a



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CONCEPTUAL PLANS FOR
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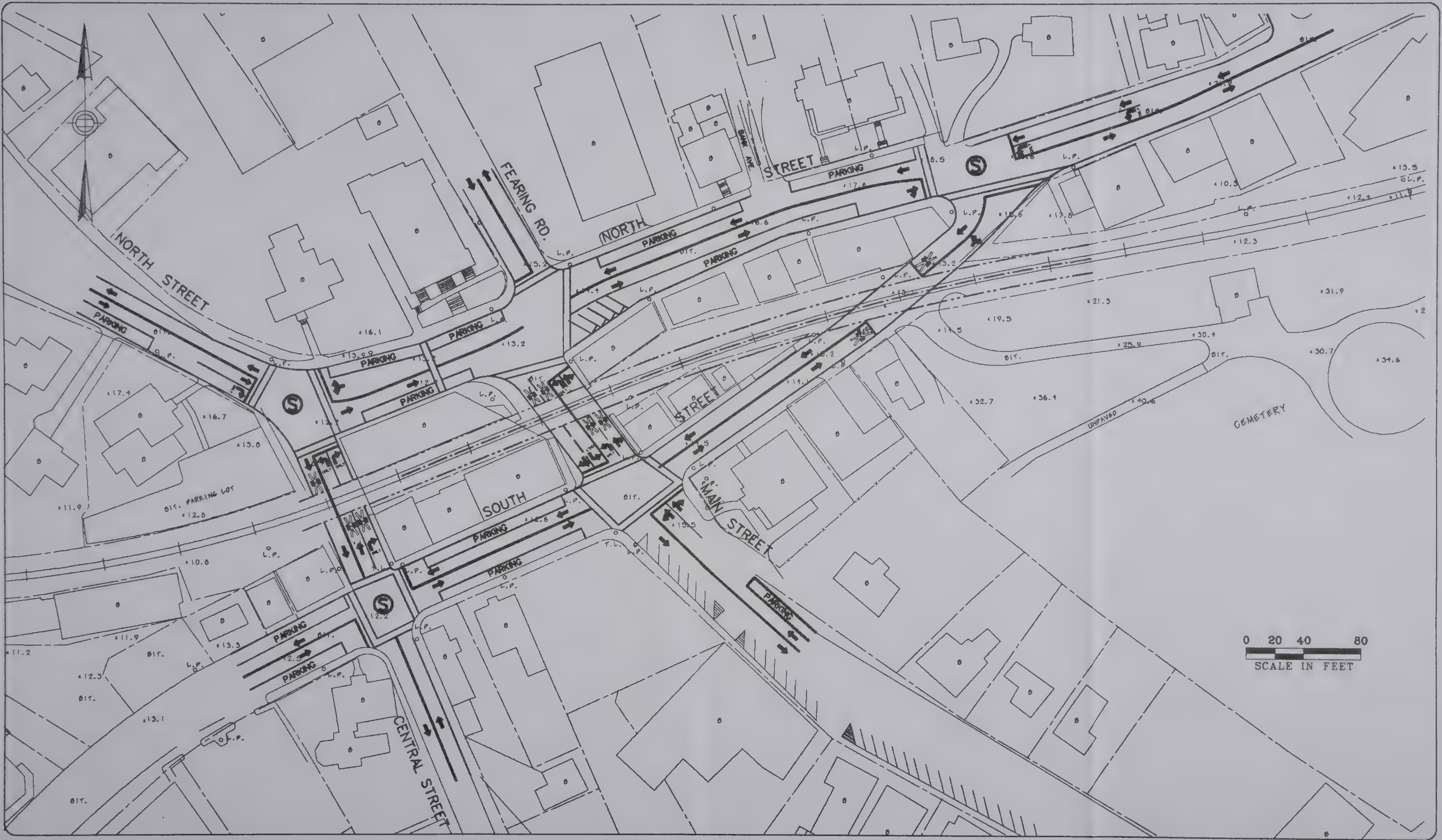
HINGHAM SQUARE - ALT. 2

Figure VIII-C23b



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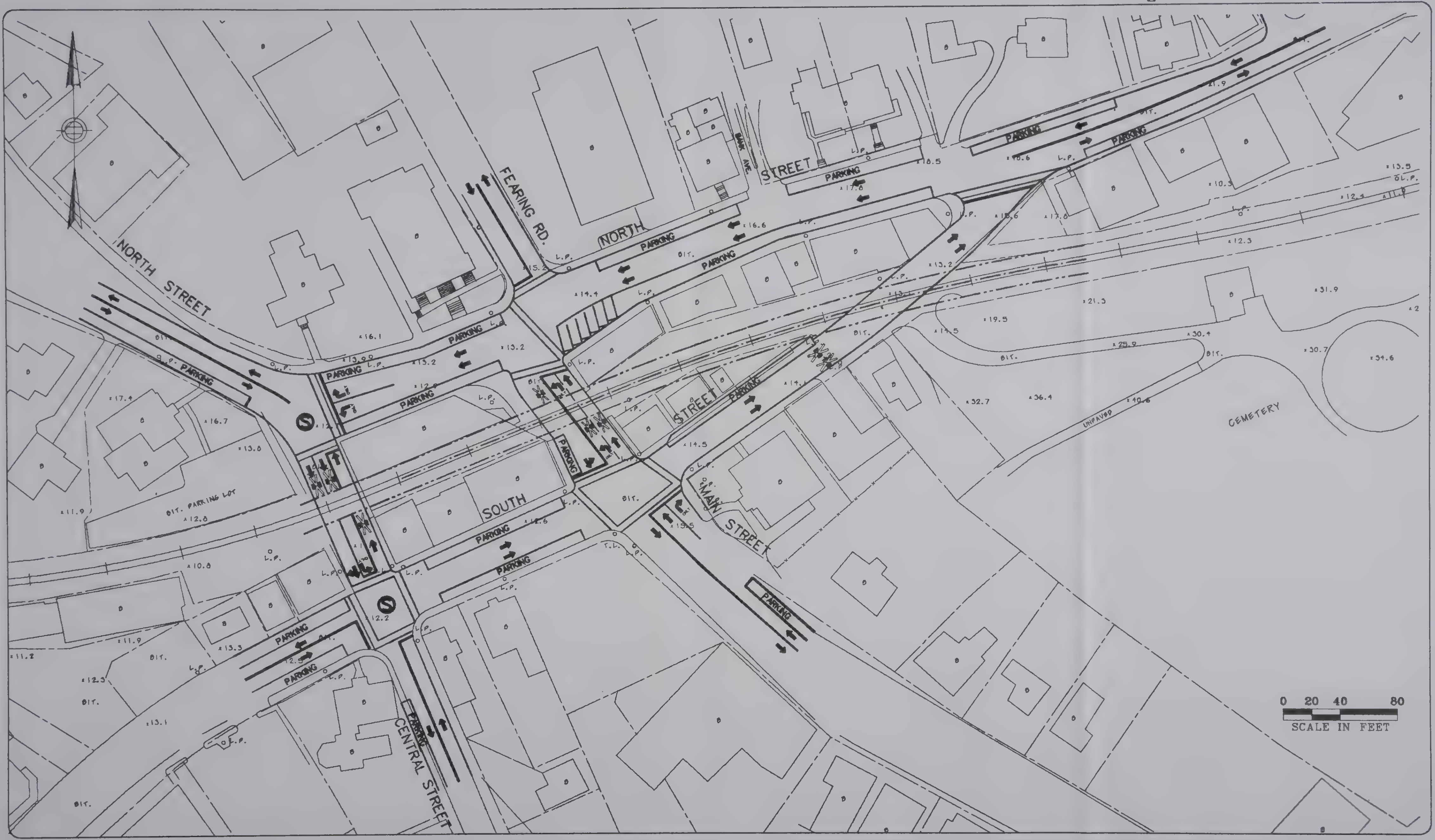
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

HINGHAM SQUARE - ALT. 3

Figure VIII-C23c



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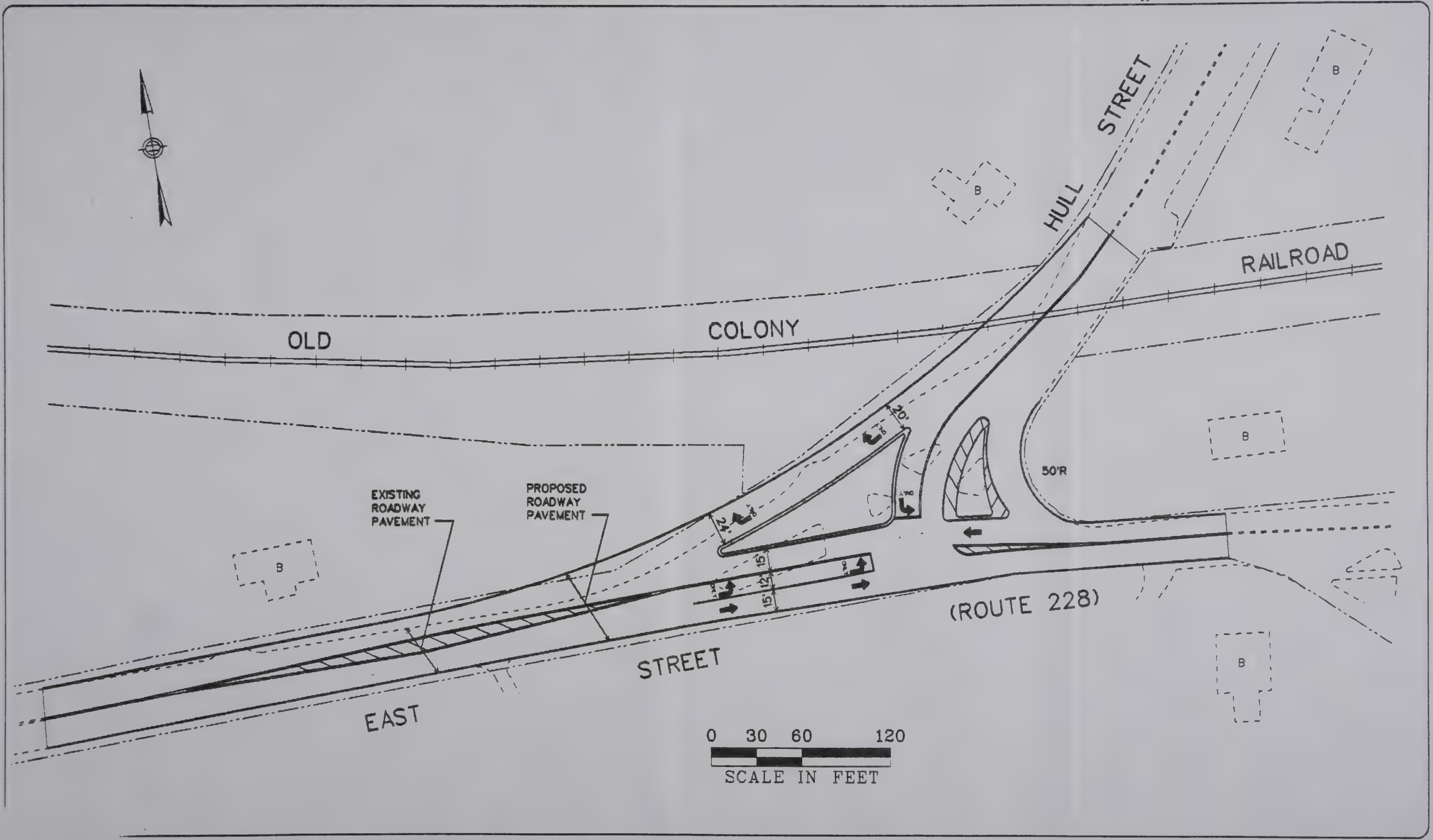
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

HINGHAM:
HULL AND
EAST STREET

Figure VIII-C24



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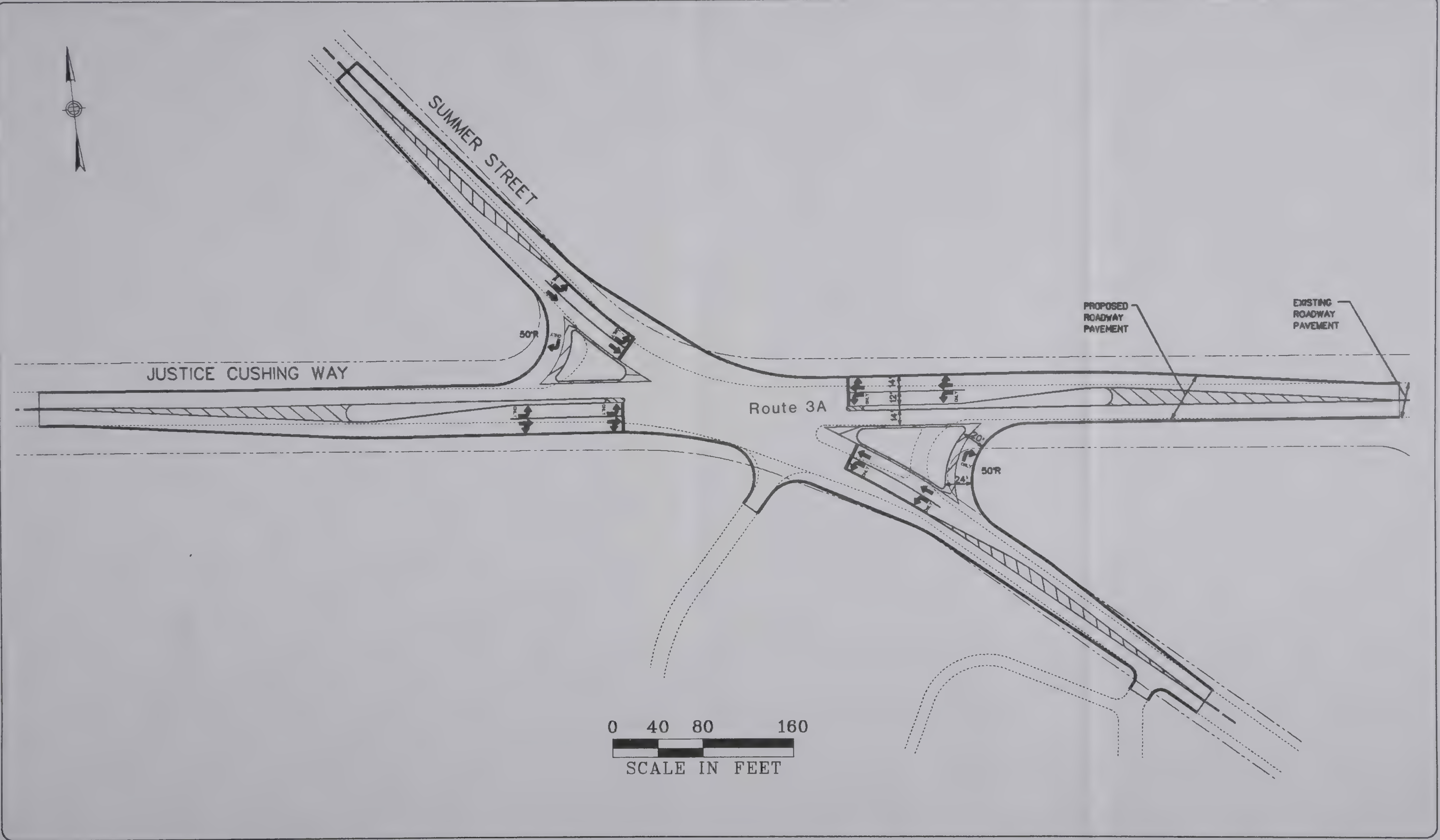
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

NANTASKET JUNCTION
JUSTICE CUSHING WAY
AND SUMMER STREET

Figure VIII-C25



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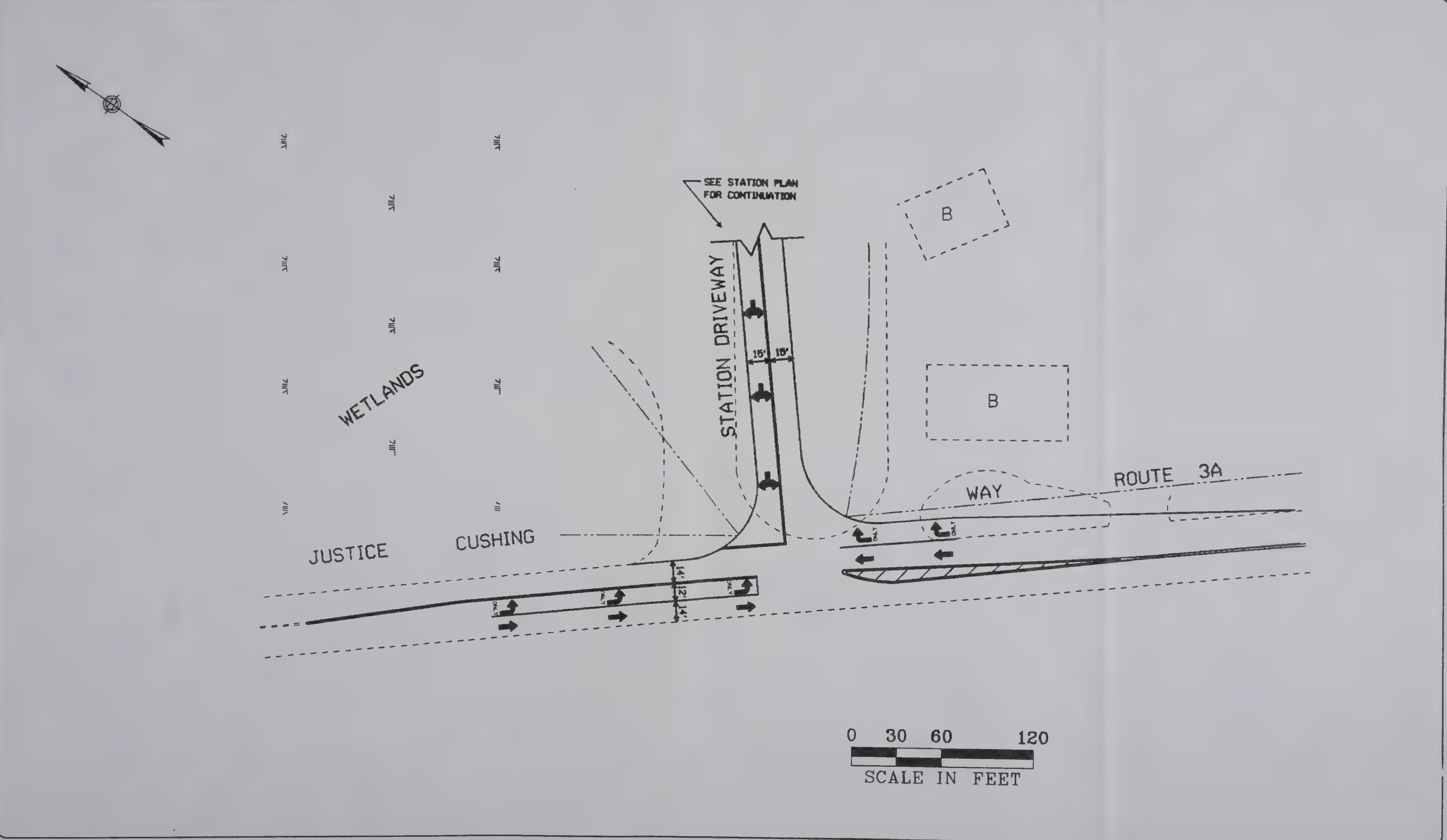
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

COHASSET:
JUSTICE CUSHING WAY
AND STATION DRIVEWAY

Figure VIII-C26



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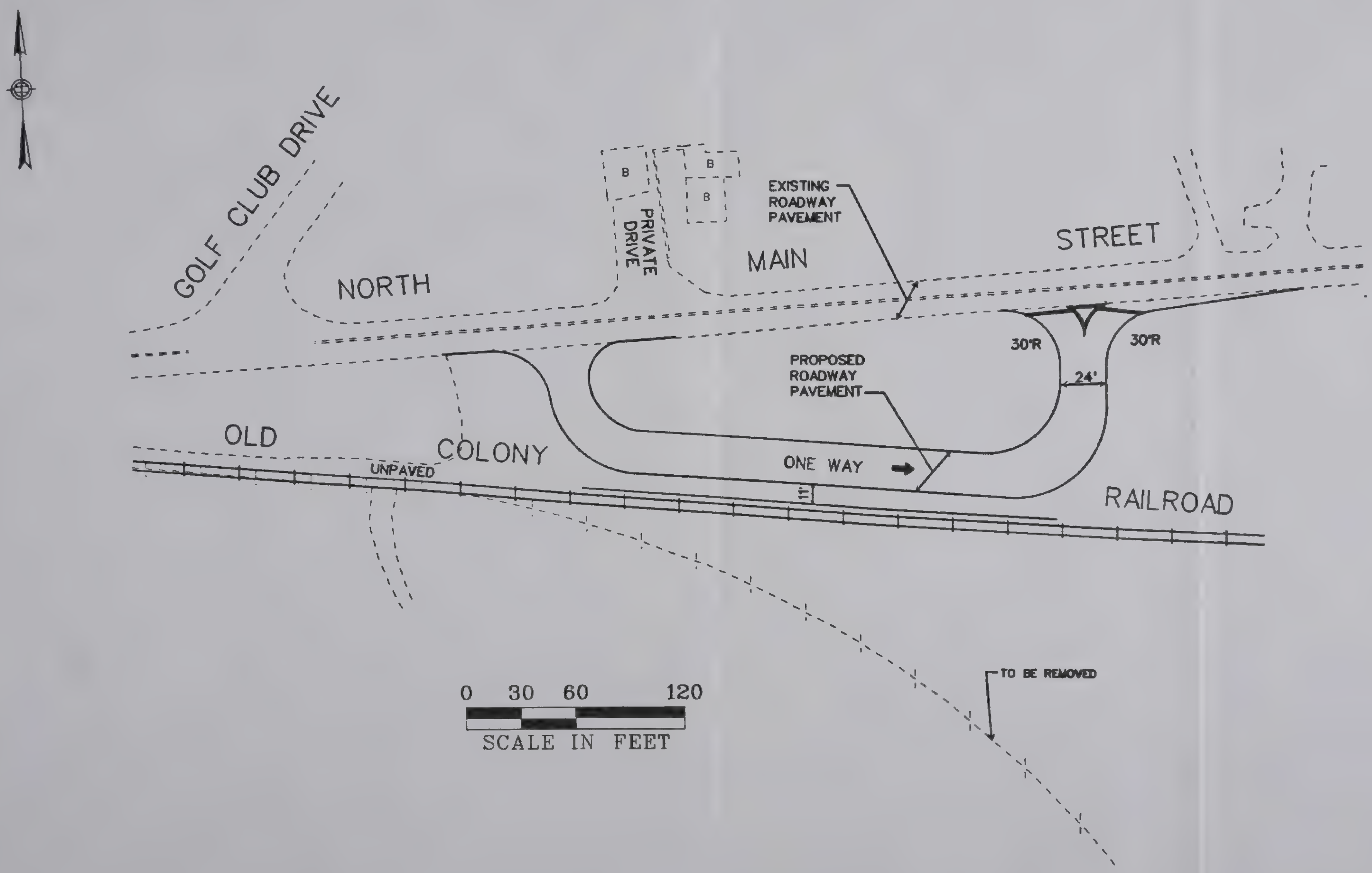
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

COHASSET:
NORTH MAIN STREET
AND STATION DROPOFF

Figure VIII-C27



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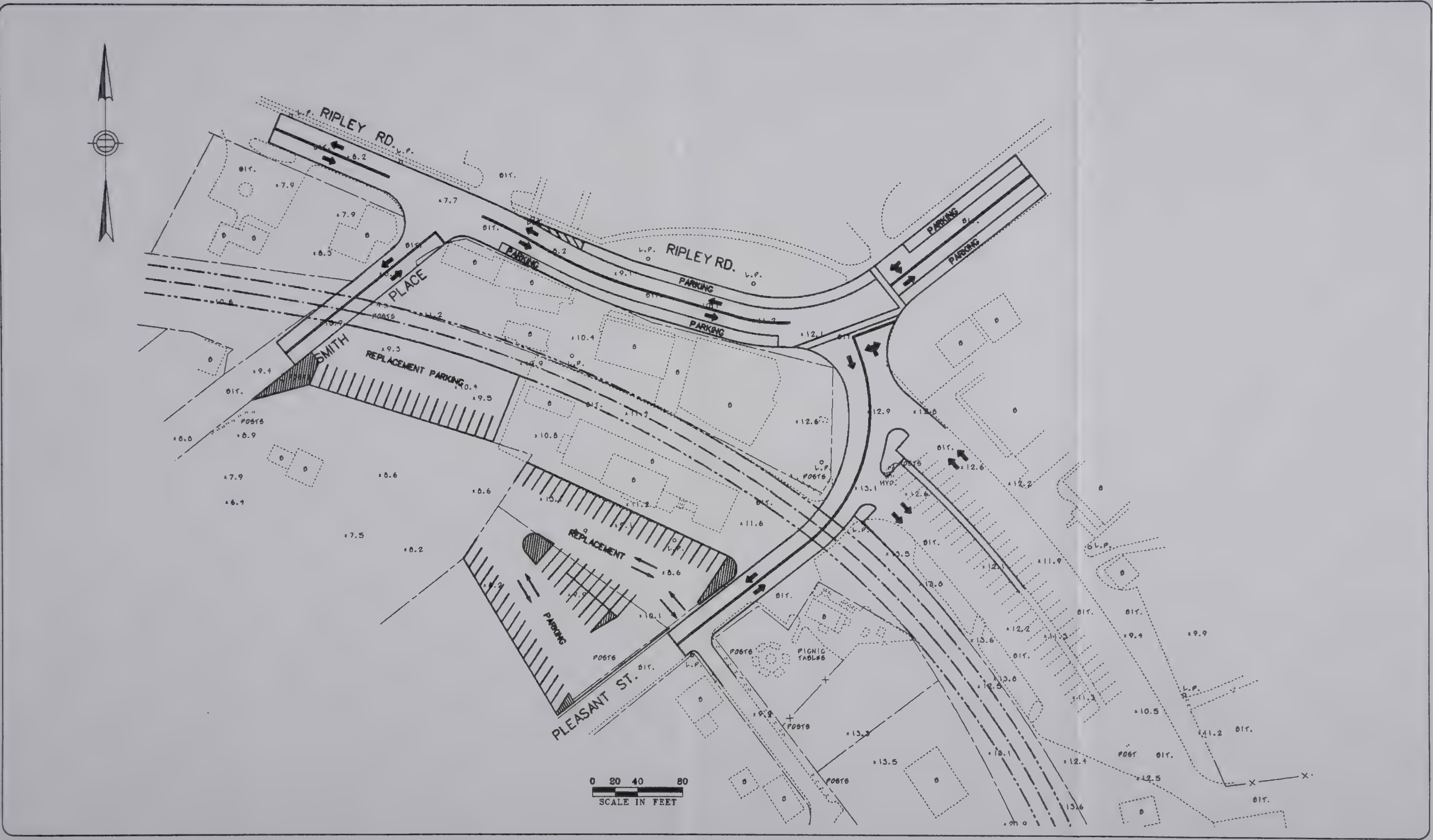
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

COHASSET VILLAGE

Figure VIII-C28



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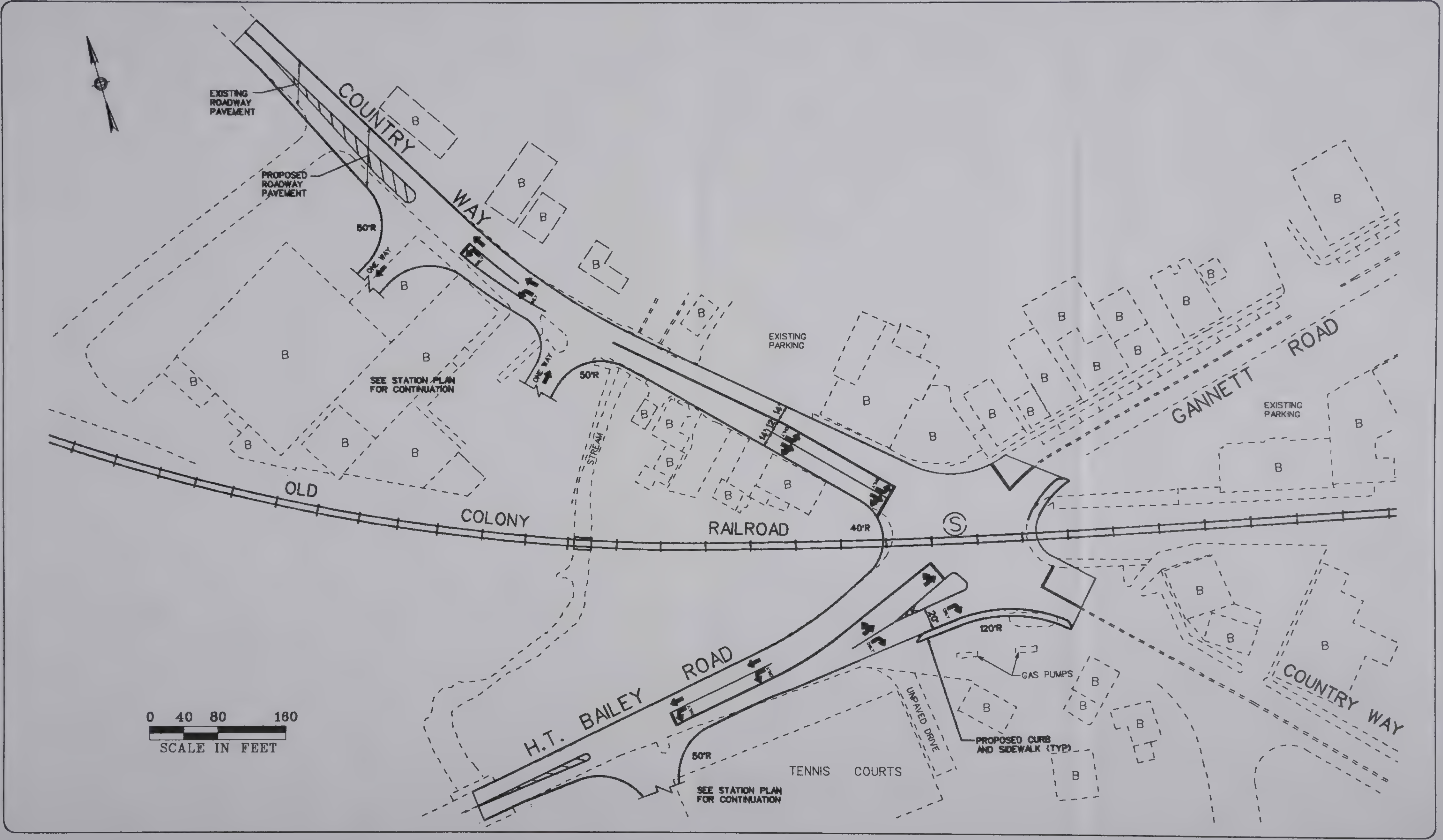
CONCEPTUAL PLANS FOR
STATION ACCESS AND
INTERSECTION IMPROVEMENTS

NORTH SCITUATE:
COUNTRY WAY,
GANNETT AND H.T. BAILEY ROAD

Figure VIII-C29



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CONCEPTUAL PLANS FOR
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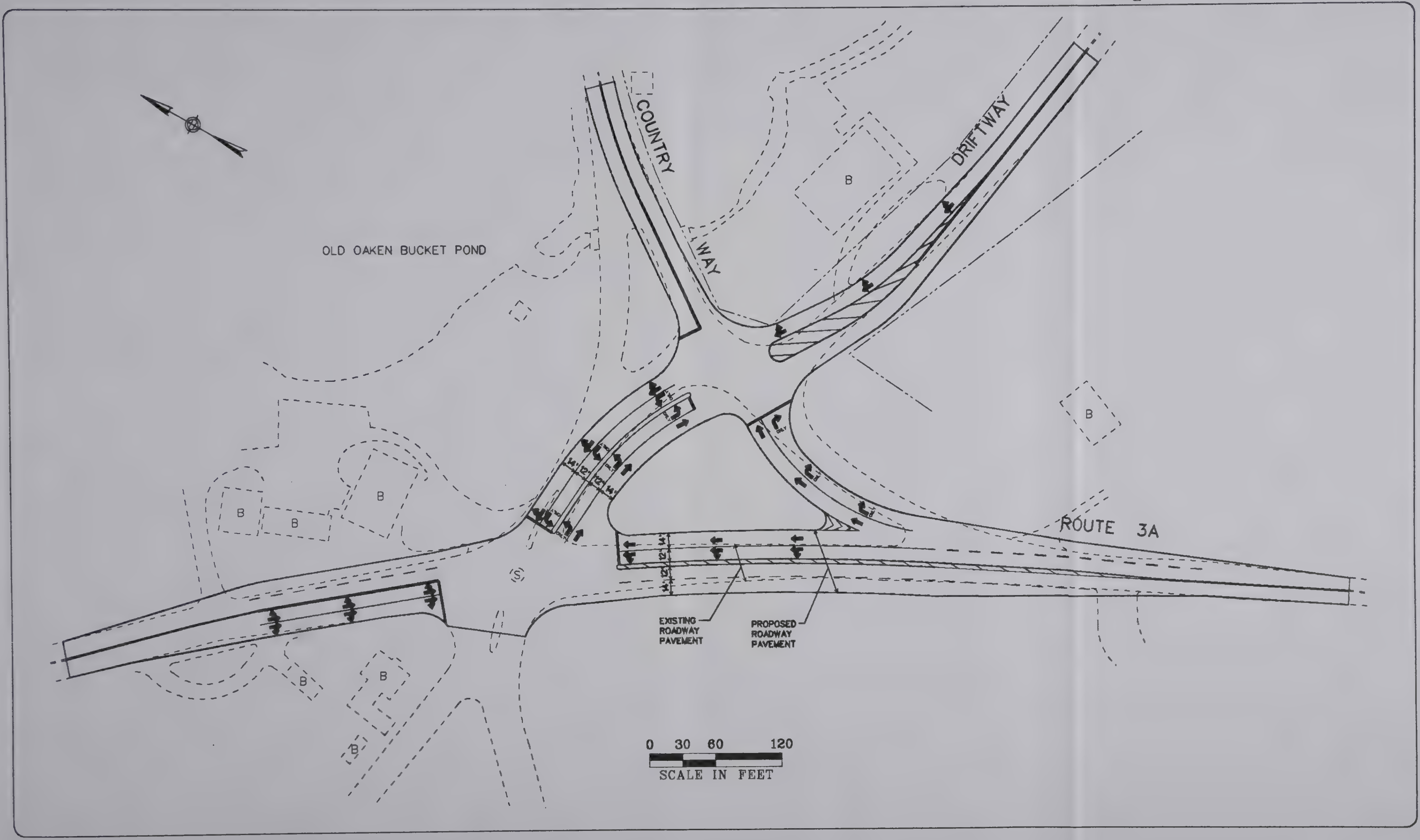
INTERSECTION IMPROVEMENTS

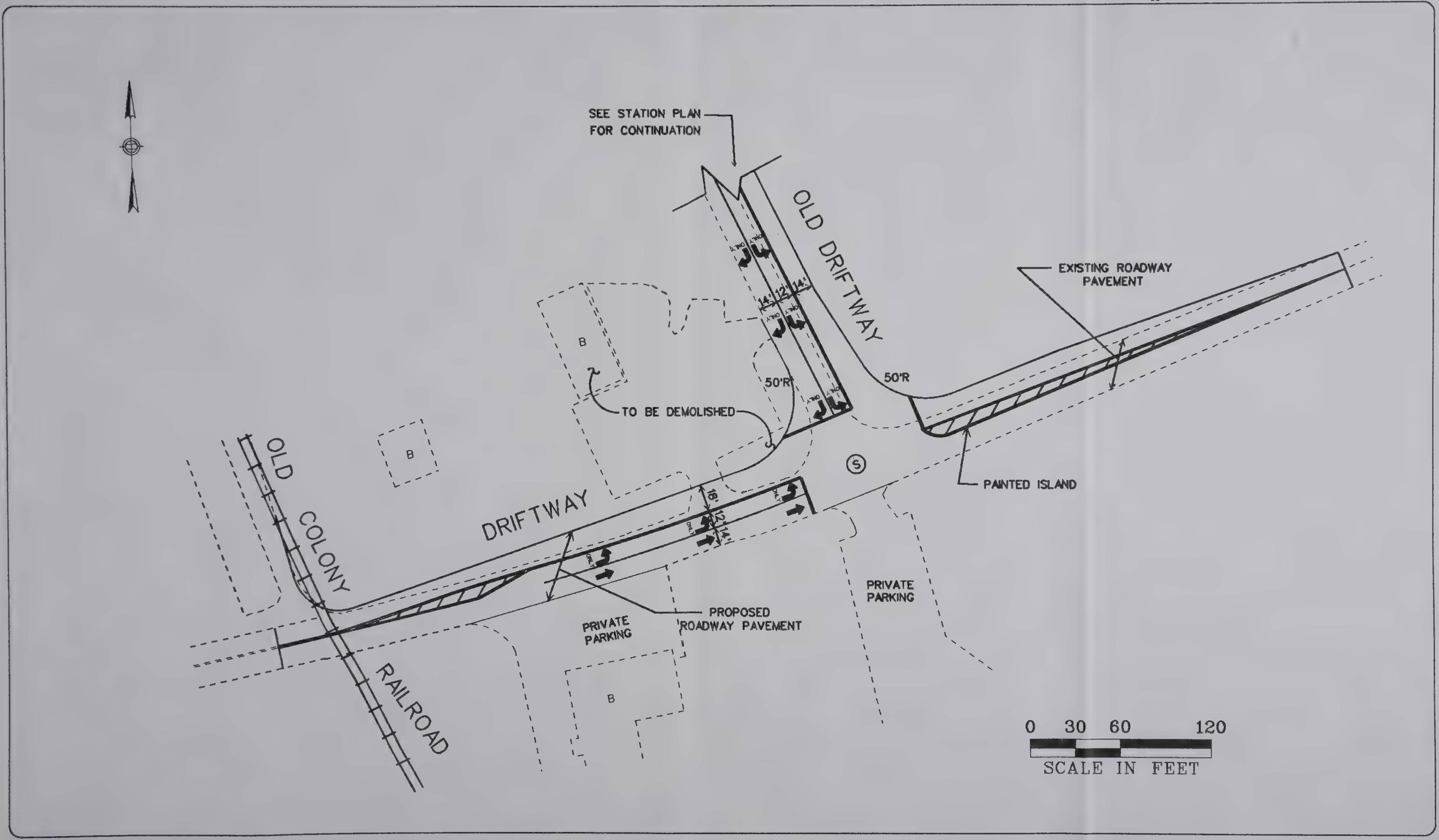
GREENBUSH:
JUSTICE CUSHING WAY
AND DRIFTWAY

Figure VIII-C30



GREENBUSH: DRIFTWAY AND OLD DRIFTWAY

Figure VIII-C31



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OMNIVM LVX CIVIVM